NATIONAL WATER QUALITY NETWORK - SUPPLEMENT 2

Plankton Population Dynamics

from a study conducted JULY 1, 1959 - JUNE 30, 1961

By Louis G. Williams, Ph. D.

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Annual Compilation of Data, October 1, 1957–September 30, 1958
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National Water Quality Network
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National Water Quality Network
Annual Compilation of Data, October 1, 1959–September 30, 1960
Public Health Service Publication No. 663 (1960 Edition)

FOREWORD

The chemical, physical and biological characteristics of surface waters are interrelated phenomena. Making greater use of the stream biota to determine existing, and to forecast future, water quality in the stream offers promising possibilities. Plankton studies within the National Water Quality Network have included extensive work designed to permit application of the principle of diatom species diversity to the development of water quality indices. The studies required development of new laboratory analytical techniques, as well as preliminary application of the methodology to surface water samples from the many diverse Network sampling points.

Published herein are data from samples collected in the 2-year period July 1959 through June 1961 at 65 of the Network stations. While this work is continuing within the Network program, it is hoped that the material here presented will enable workers in this field to evaluate the techniques described by applying them more broadly.

Richard S. Green

RICHARD S. GREEN *Chief, Basic Data Branch*
Division of Water Supply and Pollution Control

Plankton Population Dynamics

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The National Water Quality Network

The Public Health Service program for providing fundamental information on the quality of the Nation's waters stems from Public Law 660, approved July 9, 1956, as amended by Public Law 87–88, July 20, 1961. Section 4(c) thereof states: ". . . the Secretary [of Health, Education, and Welfare] shall, in cooperation with other Federal, State, and local agencies having related responsibilities, collect and disseminate basic data on chemical, physical, and biological water quality insofar as such data or other information relate to water pollution and the prevention and control therof."

To fulfill this responsibility, the National Water Quality Network collects, interprets, and disseminates:

a. Information on changes in water quality at key points in river systems, as such quality may be affected by changes in water use and development.

b. Continuous information on the nature and extent of pollutants affecting water quality.

c. Data which will be useful in the development of comprehensive water resources programs.

d. Data which will assist State, interstate, and other agencies in their water pollution control programs, and in the selection of sites for legitimate water uses.

Some 50 sampling stations were established when the program started, October 1, 1957. By January 1, 1962, the number had grown to 102.

Each sampling location satisfied one or more of the following criteria:

a. Major waterways used for public water supply, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other legitimate uses.

b. Interstate, coastal, and international boundary waters.

c. Waters on which activities of the Federal Government may have an impact.

Sampling station sites are fixed only after consultation with local, State, Federal and other agencies having related interests.

Active local participation is important in this operation. It assures maximum development of all information valuable both locally and nationally. Program costs are shared by the Federal Government and State and local agencies, those of the latter through contributions of laboratory and sampling manpower. Specifically, the State and local agencies perform most of the conventional chemical analyses and collect samples for the newer, more complex examinations. The Public Health Service, in turn, performs the more complex determinations and makes the results available to the participants. In addition, the consultation, training facilities, and other resources of the Public Health Service are available to the cooperating agencies.

Locations of sampling stations in operation as of January 1, 1962, are shown on page 3. Descriptions of the stations, participating agencies, and other pertinent information are presented on pages 5–8.

Only after careful screening of needs in water resource development was a pattern set for analyses of water samples. All Network samplings are examined for:

a. Radioactivity.
  (1) Gross alpha.
  (2) Gross beta
  (3) Strontium 90
b Plankton populations.
c. Coliform organisms.
d. Organic chemicals
e. Biochemical, chemical, and physical measurements, including biochemical oxygen demand (B.O.D.), dissolved oxygen (D.O.), chemical oxygen demand (C.O.D.), chlorine demand, ammonia nitrogen, hydrogen ion concentration (pH), color turbidity, temperature, alkalinity (or acidity), hardness, chloride, sulfate, phosphates, and total dissolved solids.
f. Trace elements.

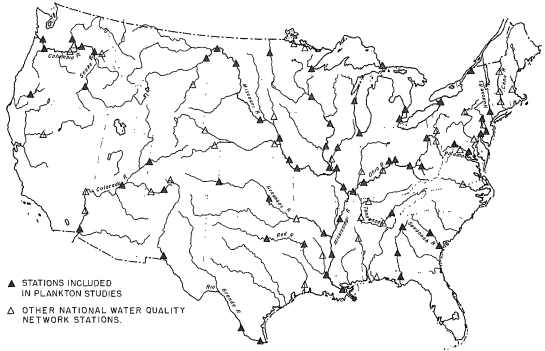
Samples for groups a, c, and e are collected and analyzed weekly. Samples for organic chemicals are collected monthly, while the schedule for plankton organism examinations is semimonthly. Strontium 90 analyses are made on composites of weekly samples accumulated over a 3-month period. Trace elements are determined on 2-month composites of weekly samples. New parameters which are developed and found significant are included as the program continues.

Water Quality Parameters

In the assessment of water quality, all of the legitimate purposes for which raw waters can be used, and which may be affected by pollution, must be considered. These may range from the minimum requirements necessary for navigation to the ultimate in water quality demanded for special industrial processing. Quality needs differ considerably, therefore, according to water use.

For domestic use water must be free of disease organisms, clear, colorless, taste- and odor-free, and must have a relatively low dissolved mineral content. Agricultural water is judged primarily on its mineral content, especially with respect to the ratio between sodium and other cations, and the presence of boron. Water for fish propagation and recreational purposes must be relatively free from domestic and industrial pollution and must be able to sustain an active flora of the smaller aquatic organisms on which fish and wildlife feed. Industrial water quality demands run the gamut from the complete absense of minerals to a requirement of low temperature, the critical factor in water used for cooling. The effects of radioactive materials on these uses have not yet been fully appraised.

National Water Quality Network Sampling Stations



Introduction to the Plankton Studies

Although many water quality and water pollution studies have been made of rivers, there has been relatively little investigation of plankton in relation to water quality. This supplemental report presents information on the plankton populations found at 65 selected stations of the National Water Quality Network. Findings reported are based upon semimonthly samplings over a 2-year period ending June 30, 1961.

Plankton are composed of algae and other plant and animal organisms, and they do have an important relationship to the quality of the water in which they live. Always present in lakes and streams, these minute organisms are vital to water's self purification process. They take up and concentrate radionuclides from the water and when the cells die, they release radionuclides in the water.

Plankton also provide food for fish and other aquatic life. They sometimes cause taste and odor problems in water supplies. They may hinder water treatment by clogging filters. Often they become so abundant as to cause a nuisance in recreational areas and deplete oxygen in the water during decomposition. Because they exhibit population dynamics, plankton can serve as important indicators of water quality. For example, pollutants in the water may alter drastically the normal population patterns of plankton—an effect which may be observed through plankton population studies.

The data herein documented will be especially valuable because identification and enumeration of the organisms were given uniform treatment, making comparisons relevant. Most other studies deal only with the larger net plankton and are not year-round studies.

In 1957 when the Network program was inaugurated, 16 sampling stations were in use on a monthly basis. At this time all diatoms including empty shells were included in the total counts. By 1959 the sampling schedule became semimonthly and the inert diatom shells were counted, separated and excluded from the total phytoplankton counts. The clump count procedure is used to tally the plankton organisms per ml. This includes all of the preservable algae larger than bacteria. In this method each single cell and natural clump or colony is recognized as a unit. From these data one may use a factor to determine other standard units.

All plankton which can be recognized in the preserved samples are being identified. These include fungi, sheathed bacteria, protozoa, crustaceans, rotifers, nematodes, and other invertebrates. Although these represent a small segment of the total population, their presence is noted for possible future use in studies of their relationship to water quality.

Much of the emphasis in the plankton program has been on diatoms. Both in total population and number of species they constitute the largest planktonic group in the rivers and Great Lakes. They are important indicators of water quality and its variations.

SAMPLING STATIONS AND COOPERATING AGENCIES

STATION	MILES ABOVE MOUTH	DESCRIPTION	SAMPLED BY	OTHER COOPERATING AGENCIES
ANIMAS RIVER above Cedar Hill, N. Mex.	33	Heizer Ranch at natural gas pipeline crossing.	San Juan County Health Dept.	New Mexico Dept. of Public Healt
APALACHICOLA RIVER at Chattahoochee, Fla.	105	Jim Woodruff Dam Powerhouse	U.S. Army Corps of Engineers Florida State Hospital, Chattahoochee, Florida.	Florida State Board of Health
ARKANSAS RIVER at Pendleton Ferry, Ark.	45	Ferry Landing, South Shore	Arkansas State Water Pollution Control Commission	Arkansas State Board of Health
at Ponca City, Okla.	646	Old U.S. Highway No. 60 Bridge (formerly at Osage Station, Okla. Gas and Electric Co.)	Ponca City Water Dept.	Oklahoma State Dept. of Health
at Coolidge, Kans.	1,099	U.S. Geological Survey Stream Gaging Station	U.S. Geological Survey	Kansas State Board of Health Colorado State Dept. of Health
CHATTAHOOCHEE RIVER at Columbus Ga.	160	Columbus Water Dept. Plant Intake	Columbus Water Dept.	Georgia State Dept. of Public Health
at Atlanta, Ga.	303	Atlanta Water Dept. Plant Intake	Atlanta Water Dept.	Georgia State Dept. of Public Health
COLORADO RIVER at Yuma, Ariz.	91	Arizona Water Co. Intake	Arizona Water Co.	Arizona State Dept. of Health
at Page, Ariz.	775	Page Water Plant Intake	U.S. Bureau of Reclamation	Arizona State Dept. of Health Utah State Dept. of Health
near Loma, Colo.	1,150	Pumping Station at E.R. Smith Farm	Mesa County (Colorado) Dept. of Public Health	Colorado State Dept. of Public Health
COLUMBIA RIVER near Clatskanie, Oreg.	53	Beaver Army Terminal U.S. Army Transp., Supply and Maintenance Command	U.S. Army U.S. Public Health Service	
at Bonneville Dam, Wash.-Oreg.	145	Bonneville Dam Powerhouse	U.S. Army Corps of Engineers	Oregon State Sanitary Authority Washington State Dept. of Health Washington State Pollution Control Commission
at Pasco, Wash.	327	Municipal Water Plant Intake	Pasco Water Dept.	Washington State Dept. of Health Washington State Pollution Control Commission
at Wenatchee, Wash.	465	Plant Intake, Aluminum Co. of America	Aluminum Co. of America Chelan-Douglas County Health Dept.	Washington State Dept. of Health Washington State Pollution Control Commission

SAMPLING STATIONS AND COOPERATING AGENCIES—Continued

STATION	MILES ABOVE MOUTH	DESCRIPTION	SAMPLED BY	OTHER COOPERATING AGENCIES
DELAWARE RIVER				
at Philadelphia, Pa.	110	Municipal Water Plant Intake (Torresdale Plant)	Philadelphia Water Dept.	Pennsylvania State Dept. of Health
at Martins Creek, Pa.	191	at Martins Creek Steam Electric Station	Pennsylvania Power and Light Co	Pennsylvania State Dept. of Health
GREAT LAKES				
Lake Erie, Niagara River at Buffalo, N.Y.	—	Municipal Water Plant Intake	Buffalo Water Dept. Erie County (N.Y.) Health Dept.	New York State Dept. of Health
Lake Huron, Detroit River at Detroit Mich	29	Municipal Water Plant Intake (Water Works Park)	Detroit Board of Water Commissioners	Michigan State Dept. of Health Michigan State Water Resources Commission
Lake Huron St. Clair River at Port Huron, Mich	38	Municipal Water Plant Intake	City of Port Huron, Michigan	Michigan State Dept. of Health International Joint Commission Michigan State Water Resources Board
Lake Michigan at Gary, Ind	—	Gary-Hobart Water Corp. Intake	Gary-Hobart Water Corp.	Indiana State Board of Health
Lake Michigan at Milwaukee, Wis.	—	Municipal Water Plant Intake	City of Milwaukee, Wisconsin	Wisconsin State Board of Health
Lake Superior at Duluth, Minn	—	Municipal Water Plant Intake	Duluth Water, Gas and Sewage Treatment Dept.	Minnesota State Dept. of Health
Lake Superior, St Mary's River at Sault Ste Marie, Mich.	48	Municipal Water Plant Intake	Sault Ste. Marie Water Dept.	Michigan State Dept. of Health
HUDSON RIVER				
below Poughkeepsie, N.Y.	70 (est)	International Business Machine Corp. Plant Intake	International Business Machine Corp.	New York State Dept. of Health
ILLINOIS RIVER				
at Peoria, Ill.	166	Peoria Water Works Co. Plant Intake	Peoria Water Works Co.	Illinois State Dept. of Public Health
KANAWHA RIVER				
at Winfield Dam, W. Va.	30	Winfield Dam Power Plant	West Virginia Water Resources Commission	Kanawha Valley Power Company West Virginia State Dept. of Health
KLAMATH RIVER				
at Keno, Oreg	220	one mile below Copco Hydrogenerating Plant	City of Klamath Falls Klamath County Health Dept.	California-Oregon Power Company
LITTLE MIAMI RIVER				
at Cincinnati, Ohio	2	Robert A. Taft Sanitary Engineering Center Raw Water Intake	Public Health Service	City of Cincinnati, Ohio
MISSISSIPPI RIVER				
at East St. Louis, Ill.	1,166	East St. Louis Water Co. Intake	East St. Louis Water Co.	Illinois State Dept. of Public Health
at Burlington, Iowa	1,369	Municipal Water Plant Intake	Burlington Water Dept.	Iowa State Dept of Health
at Dubuque, Iowa	1,549	U.S Army Corps of Engineers Lock and Dam #11	Dubuque Water Dept.	Iowa State Dept. of Health
at Lock and Dam #3 below St. Paul Minn.	1,757	U.S. Army Corps of Engineers Lock and Dam #3	U.S. Army Corps of Engineers Minneapolis-St. Paul Sanitary District	Minnesota State Dept. of Health

SAMPLING STATIONS AND COOPERATING AGENCIES—Continued

STATION	MILES ABOVE MOUTH	DESCRIPTION	SAMPLED BY	OTHER COOPERATING AGENCIES
at New Orleans, La.	105	Municipal Water Plant Intake	New Orleans Sewage and Water Board	Louisiana State Dept. of Health
at Delta, La. (formerly at Vicksburg, Miss.)	433	River Landing, Delta Casting Yard, U.S. Corps of Engineers	Mississippi State Board of Health	Louisiana State Dept. of Health
at West Memphis, Ark.	726	Barge Terminal, Oklahoma-Mississippi River Products Lines, Inc.	Memphis (Tennessee) Light, Gas and Water Division	Arkansas State Board of Health Tennessee State Dept. of Public Health
at Cape Girardeau, Mo.	1,020	Missouri Utilities Co. Water Intake	Missouri Utilities Co.	Missouri State Dept. of Public Health and Welfare
MISSOURI RIVER				
at St. Louis, Mo.	36	Water Plant Intake, St. Louis County Water Co. and Howard Bend Plant, City of St. Louis	St. Louis County Water Dept. St. Louis Water Dept.	Missouri State Dept. of Public Health and Welfare
at Kansas City, Kans.	385	Municipal Water Plant Intake	Kansas City (Kansas) Board of Public Utilities	Kansas State Board of Health
at St. Joseph, Mo.	471	St. Joseph Water Co. Intake	St. Joseph Water Co	Missouri State Dept. of Public Health and Welfare
at Omaha, Nebr.	642	Metropolitan Utilities Dist. Water Plant Intake	Metropolitan Utilities District	Nebraska State Dept. of Health
at Yankton, S. Dak.	841	Municipal Water Plant Intake	Yankton Water Dept.	South Dakota State Board of Health
at Bismarck, N. Dak.	1,377	Municipal Water Plant Intake	Bismarck Water Dept.	
at Williston, N. Dak.	1,644	Municipal Water Plant Intake	Williston Water Dept.	North Dakota State Dept. of Health
OHIO RIVER				
at Cairo, Ill.	3	Cairo Water Co. Intake	Cairo Water Co.	Illinois State Dept. of Public Health
at Evansville, Ind.	190	Municipal Water Plant Intake	Evansville Water Dept.	Indiana State Board of Health
at Cincinnati, Ohio	518	Municipal Water Plant Intake	Cincinnati Water Dept.	Ohio State Dept. of Health
at Huntington, W. Va.	677	Huntington Water Co. Intake	Huntington Water Corp.	West Virginia State Dept. of Health
at East Liverpool, Ohio	941	Municipal Water Plant Intake	East Liverpool Water Dept	Ohio State Dept of Health
POTOMAC RIVER				
at Great Falls, Md.	126	Washington, D.C. Water Plant Intake	U.S. Army Corps of Engineers	Maryland State Dept. of Health
at Williamsport, Md.	212	Hagerstown Municipal Water Plant Intake	Hagerstown Water Dept.	Maryland State Dept. of Health
RED RIVER (North)				
at Grand Forks, N. Dak.	296	Municipal Water Plant Intake	Grand Forks City Water Dept.	North Dakota State Dept. of Health
RED RIVER (South)				
at Alexandria, La.	122	Pumping Station on Levee near City Wells	Alexandria Water Dept.	Louisiana State Dept. of Health
at Index, Ark.	485	U.S. Highway No. 71 Bridge	Texarkana Water and Sewer Systems Arkansas State Water Pollution	Arkansas State Board of Health

SAMPLING STATIONS AND COOPERATING AGENCIES—Continued

STATION	MILES ABOVE MOUTH	DESCRIPTION	SAMPLED BY	OTHER COOPERATING AGENCIES
RIO GRANDE at Brownsville, Tex.	40	Brownsville Filtration Plant Plant #1 Intake	Brownsville Water Dept.	Texas State Dept. of Health
at Laredo, Tex.	356	Municipal Water Plant Intake	Laredo Water Dept.	Texas State Dept. of Health
at El Paso, Tex.	1,234	Municipal Water Plant Intake	El Paso Public Service Board	Texas State Dept. of Health
ST. LAWRENCE RIVER at Massena, N.Y.	422	Aluminum Foundry Plant Intake	Chevrolet Motor Div., General Motors Corp., Aluminum Foundry	New York State Dept. of Health
SAVANNAH RIVER at Port Wentworth, Ga.	22	State Highway No. 17 Bridge	Union Bag-Camp Paper Co. U.S. Army Corps of Engineers Chatham County Health Dept.	Georgia State Dept. of Public Health
at North Augusta, S.C.	217	Municipal Water Plant Intake	North Augusta Water Dept.	South Carolina State Dept. of Health
SCHUYLKILL RIVER at Philadelphia, Pa.	10	Municipal Water Plant Intake	Philadelphia Water Dept.	Pennsylvania State Dept. of Health
SNAKE RIVER at Wawawai, Wash.	111 (est)	Pumping Station at I. E. Wilson Farm	Washington State College	Washington State Dept. of Health
at Weiser, Idaho	354	Municipal Water Plant Intake	Weiser Water Dept.	Idaho State Board of Health
TENNESSEE RIVER at Chattanooga, Tenn.	467 (est)	City Water Company Intake	City Water Company of Chattanooga	Tennessee State Dept. of Public Health
YELLOWSTONE RIVER at Sidney, Mont.	30	Intake-Lewis and Clark Station Montana-Dakota Utilities Co.	Montana-Dakota Utilities Co.	Montana State Board of Health

Equipment, Materials and Methods

Samples of raw water are collected semimonthly from each Network station and sent for processing to the Public Health Service's Water Quality Laboratory, Cincinnati, Ohio. Each sample is taken directly from the river or lake, or from a continuously flowing intake (as at a water treatment plant) receiving the river or lake water.

The sample, consisting of three liters of untreated water, is added to 100 ml. of preservative (thimerosal, 0.16 percent, plus Lugol's solution, 1 percent) in a polyethylene sample bottle. The Lugol's solution stains parts of the cells making identification easier. It also aids in settling the plankton since the iodine causes some of them to lose gas and, therefore, their buoyancy. This preservative has been found to be effective for approximately 1 month during the warm seasons and longer during cool weather. One gram of sodium borate is added for each gram of thimerosal to help keep the thimerosal in solution.

Three analyses, each requiring one liter, are performed per sample: (1) the genera of phytoplankters are identified and enumerated using the Sedgwick-Rafter slide technique; (2) the genera of microinvertebrates, mostly rotifers and crustaceans, are settled, identified to genus and counted in a special microslide; and (3) the diatoms are settled, washed and made into a permanent hyrax slide from which are made proportional counts of the species and some of the varieties. These determinations are also used to qualitate to genus the diatoms recorded in the Sedgwick-Rafter (step one) procedure and to make the proportional counts in step three.

Phytoplankters counted in the Sedgwick-Rafter slide include forms, measuring four microns or more. Clump counts are made of fungi and sheathed bacteria. The Sedgwick-Rafter counts for total algae that were alive when collected are made as clump counts in which each single-celled individual or natural clump or colony of cells is enumerated as one. Diatom shells without chromatophores are tallied separately from preserved diatoms with chromatophores.

Because tiny centric and pennate diatoms cannot be adequately identified to genus from the Sedgwick-Rafter slide, their determination is dependent on accurate identification during proportional counting from permanent hyrax slides. However, all other algae are determined to genus, including the colonial diatoms *Melosira*, *Asterionella*, *Fragilaria* and *Tabellaria*. These diatoms form natural aggregates or colonies and can be recognized in a Sedgwick-Rafter cell. All other diatoms, however, are counted only as centrics or pennates since identification, even to genus, is often obscure with the resolution and magnification (200X) available in the Sedgwick-Rafter method. The identification and relative abundance of various diatom species are determined from a permanent hyrax slide and these findings are used to identify the genera of the diatoms in each Sedgwick-Rafter count.

In concentrating by centrifugation of raw samples low in phytoplankton a moderate proportion of buoyant forms is lost, broken apart or so compacted with their spines or gelatinous secretions that they cannot be redistributed randomly for counting under the microscope. For these reasons most of the quantitation of phytoplankters has been obtained from unconcentrated or undiluted raw water samples. The count is in a Sedgwick-Rafter slide using 20-power objectives and 10-power oculars, and is accomplished by counting two lengthwise strips (about 500 microns) the width of the Whipple square.

These two strips represent a volume of about 0.05 ml. To obtain the number of plankters per ml., a factor of 20 to 22 is used, varying with the correction for preservative dilution and differences in calibration of the microscopes. Precise techniques have been developed for obtaining representative and geometrically accurate one-ml. samples for counting in the Sedgwick-Rafter slide.

For the rare occasions where concentrations of phytoplankton were necessary, settling proved to be the best method, affording the least loss or distortion of organisms. Furthermore, this concentration technique has the advantage of allowing the sediment to be washed with distilled water to free it of colloidal material and some of the silt particles, which interfere with optics in some of the turbid samples.

Identification of diatom species and their proportional census is done from incinerated frustules of diatoms settled and washed from a liter of sample. The washed sediment containing the diatoms is dried on a warming table on a number one coverglass, and this sediment is ashed in place on the coverslip on a red-hot hotplate. This method does not appear to change the minute identification markings of the siliceous cell walls and enables the two valves (epitheca and hypotheca), as well as the groups of cells attached to one another, to remain in a natural grouping, so that Sedgwick-Rafter counts and proportional counts can be matched.

Chemical cleaning was abandoned because bubbling separates the valves, distorts natural cell grouping, and tends to inflate the actual count. Permanent slide mounts are made with hyrax medium. The technique of settling, washing in distilled water, and mounting does not appear to alter the uniformity of the diatom species composition. Proportional counts are made with 90-power oil immersion apochromatic objectives and 10-power oculars containing a Whipple micrometer grid. Random strip counts are made until the total number of units reaches 200 to 300. Higher counts are necessary when one or two species are overwhelmingly abundant.

Identification to species is facilitated by the described techniques in settling, washing and hyrax preparation, and by the use of the best optical lenses available.

Proportional counting of diatoms from permanent slides is on a modified unit-area basis, in which each single cell or each portion of a natural aggregate occupying up to 300 square microns is tallied as one unit, cells or aggregates occupying from 300 to 1,000 square microns as two, those 1,000 to 2,500 square microns as three, those 2,500 to 5,000 square microns as four, and those over 5,000 square microns as five. The Whipple grid makes this scaling simple. This system gives a slight weighting to the larger specimens and colonies, which are seldom numerically abundant, but it is basically the same as the Sedgwick-Rafter count used for enumerating the other phytoplankters. About 95 percent of the cells or clumps naturally fall into size class one or two.

Proportional Counting

The numbers and kinds of diatoms obtained from the one-liter sample aliquot usually provide sufficient organisms for a kinds-to-numbers determination. This involves identifying and counting enough diatoms of the four most abundant species and the remainder. For this analysis, counting of great numbers was found unnecessary; the percentages of the total diatom count are determined for the four most numerous species after counting only about 250 or so individuals. Further counting does not significantly change the proportion of the total population thus found to be represented by the four predominant species.

This more rapid method of determining the species diversity by using diatoms was developed because of the large number of samples processed from the National Water Quality Network. A trained counter requires about 45 minutes to read an average slide.

Some generalizations about community dynamics are possible because a separate tally is maintained for each species. The diatom charts (pages 15 and 16), showing the relative occurrence of the four species most abundant at 65 stations, dramatically show the distribution and species character of the Network.

Biotic Characterization of Waterways

The organisms most abundant at any sampling station at any given time are the most reliable key to conditions of the environment. Species present in relatively lower numbers may not be reliable for this purpose because they sometimes represent organisms washed into the stream from ponds, creeks and other minor aquatic habitats. Furthermore, the flowing together of two unlike principal streams may produce a segment of mixing water containing organisms that do not represent true environmental conditions. Surviving healthy organisms become reliable indicators when they continue to multiply in the new water mixture and become predominant.

The four most abundant diatom species reflect in most situations the environmental conditions in the streams and Great Lakes. They were used during this investigation to indicate differences in water quality and other environmental conditions. Rare organisms are frequently encountered in streams that receive biota from other streams or lakes with unlike environments. Relatively dense, healthy plankton populations of several species, however, are very useful, because they usually represent favorable environmental conditions.

In analyzing the plankton from the same rivers and lakes for over three years, one is impressed with the "personality" of each river and many of its stations, based on the kinds of dominant biota each supports. The person engaged in plankton identification and enumeration soon learns to recognize many of the rivers and even individual stations by the characteristic plankton each produces. The table on page 13, wherein letters are used to show the presence of individual species, reveals the similarities among stations on a given stream. For example, similarities are noted between the stations of the Great Lakes and between those of the Columbia River. Also, the Southeast, the Northeast, the Southwest, and the upper and lower Mississippi River each have their characteristic diatom floras.

A decided marine influence at three of the Network stations is evidenced by the brackish diatoms always present. These are Poughkeepsie, New York on the Hudson River; Port Wentworth, Georgia on the Savannah River; and Philadelphia, Pennsylvania on the Delaware River. In addition, the diatoms of Port Wentworth include species typical of the South Atlantic coastal waters.

Some other coastal stations have shown marine influence after periods of low rainfall, which allows brackish water to back up during periods of high tide. *Cyclotella striata* is the most common species from these stations, but brackish species of *Coscinodiscus denarus* are also numerous.

Diatoms found in large numbers in all major drainage basins and the Great Lakes are *Diatoma vulgare*, *Fragilaria crotonensis*, *Melosira ambigua*, *Melosira granulata*, and *Stephanodiscus hantzschii*.

Diatoms characteristic of the Great Lakes (absent or extremely rare at river stations) are *Cyclotella comta*, *Cyclotella kutzingiana*, *Melosira binderana*, *Melosira islandica* and *Rhizosolenia eriense*.

Diatoms characteristic of the Arkansas, Colorado and Rio Grande rivers (arid regions with waters of high calcium carbonate hardness and often with high dissolved salts) are *Amphiprora alata*, *Amphiprora paludosa*, *Amphora ovalis*, *Biddulphia laevis*, *Caloneis amphisbaena*, *Pleurosigma delicatula*, *Surirella brightwellii* and *Surirella striatula*. In the Red River (south) *Diploneis smithii* dominate.

Certain diatoms dominate for short periods at widely separated stations, but are characteristic for these stations by their abundance and high fidelity. The Southeast is represented by *Cyclotella pseudostelligera* and *Melosira distans* variety *alpigena*. Buffalo, New York and Peoria, Illinois are identified by the high incidence of *Stephanodiscus niagarae*. While *Tabellaria fenestrata* is widely distributed, it overwhelmingly dominates at Gary, Indiana.

In the Ohio River, except East Liverpool, Ohio, two species of *Melosira* are abundant: *M. ambigua* and *M. granulata*. A large centric diatom *Stephanodiscus niagarae* variety *magnifica* is characteristic of the Klamath River. The Colorado, Snake and Yellowstone rivers often have fossil species of diatoms

The stations with the highest counts (productivity) are Peoria, Illinois; Ponca City, Oklahoma; St Paul, Minnesota; Keno, Oregon and Grand Forks, North Dakota.

While Gary, Indiana has the highest productivity of the Great Lakes stations, its counts are low when compared with those of high productive river stations. In general the lowest production stations are on the Great Lakes and in the Southeast.

Most of the 65 stations represented in this report have their highest counts during February–May. Only 13 of the 65 had their highest counts during October–January.

High temperatures and impounded water promote dense populations of blue-green algae in the late summer and early fall at several stations such as Cincinnati on the Ohio River.

Heavy turbidity drastically reduces the planktonic biota, particularly evident in the lower Missouri river.

Achnanthes minutissima, reported by ecologists to be an indicator of high dissolved oxygen, is common in the headwaters of the Columbia River.

Asterionella formosa and *Diatoma elongatum* become abundant during cold water seasons.

stribution of Most Abundant Species of Diatoms

RIVERS	Stations 1	2	3	4	5	6	7	8
	kPN	kdP	PVm	mPA				
	ZAW	kdL						
ne	kLY							
	Chj	kXL	kXL					
	Qdf	bhD	Bxg					
de	MIZ	IcP	FEB					
h)	IMQ	MIc	MIc					
	QdI	QkT	QTi	dTI	IVd			
	Okd	Odb	Oda	dcI	cdL	DLe	LKD	
i	QdT	QdI	QdT	Qdc	dQI	IQT	QdT	dIQ
	TQJ							
	dWL	ALG						
	SKH	SQY						
	dQe							
es	NeR	PdU	PmO	Umx	Pmd	mPA	mQR	

e are the three species occurring most frequently in the one year period ending June
t each of the plankton study stations in 15 Network waterways (including the Great
single unit). This three-species identification affords a simple, quick comparison
e important diatoms and demonstrates the distinct "personalities" of the sampling
ach three-letter symbol represents a station and the stations (except the Great Lakes)
ed in upstream sequence beginning at the river mouth.

Key to Species

A	Achnanthes minutissima
B	Amphiprora paludosa
C	Anomoeoneis exilis
D	Asterionella formosa
E	Biddulphia laevis
F	Caloneis amphisbaena
G	Cocconeis placentula
H	Coscinodiscus denarius
I	Cyclotella meneghiniana
J	Cyclotella striata
K	Cymatosira beligica
L	Diatoma vulgare
M	Diploneis smithii
N	Fragilaria capucina
O	Fragilaria construens
P	Fragilaria crotonensis
Q	Melosira ambigua
R	Melosira binderana
S	Melosira distans alpigena
T	Melosira granulata
U	Melosira islandica
V	Melosira varians
W	Navicula cryptocephala
X	Navicula viridula
Y	Navicula sp.
Z	Nitzschia lanceolate group
a	Nitzschia linearis
b	Nitzschia palea type
c	Stephanodiscus astraea minutula
d	Stephanodiscus hantzschii
e	Stephanodiscus niagarae
f	Surirella brightwellii
g	Surirella ovata
h	Surirella striatula
i	Synedra acus
j	Synedra tabulata
k	Synedra ulna
l	Synedra vaucheriae
m	Tabellaria fenestrata
x	Other entity

*Diatom Species Occurring at the Study Stations**

October 1959–June 1961

Achnanthes lanceolata Bréb.
Achnanthes minutissima Kütz.
Amphiprora alata Kutz.
Amphiprora paludosa W. Smith
Amphora ovalis Kutz.
Anomoeoneis exilis (Kutz) Cleve
Asterionella formosa Hassall
Bacillaria paradoxa Gmelin
Biddulphia laevis Ehr
Caloneis amphisbaena (Bory) Cleve
Ceratoneis arcus Kutz
Cocconeis pediculus Ehr.
Cocconeis placentula Ehr.
Coscinodiscus rothii (Ehr.) Grun.
Cyclotella atomus Hust
Cyclotella comta (Ehr) Kütz.
Cyclotella glomerata Bachm.
Cyclotella kutzingiana Thwaites
Cyclotella meneghiniana Kutz
Cyclotella pseudostelligera Hust.
Cyclotella stelligera Cl. & Grun.
Cyclotella striata (Kg) Grun.
Cymatopleura solea (Bréb) W. Smith
Cymatosira beligica Grunow
Cymbella affinis Kutz
Cymbella tumida (Breb) Heurck
Cymbella ventricosa Kutz.
Diatoma anceps (Ehr.) Grunow
Diatoma elongatum C A. Agardh
Diatoma vulgare Bory
Diploneis smithii (Bréb.) Cleve
Epithemia turgida (Ehr) Kutz.
Epithemia sorex Kutz.
Eunotia pectinalis (Kutz) Raben.
Fragilaria brevistriata Grun.
Fragilaria capucina Desm.
Fragilaria construens (E.) Grun.
Fragilaria crotonensis Kitton
Fragilaria leptostauron (Ehr.) Hust.
Fragilaria pinnata Ehr.
Fragilaria virescens Ralfs.
Frustulia vulgaris Thwaites
Gomphoneis herculeana (Ehr.) Cleve
Gomphonema olivaceum (Lyngb.) C. Ag.
Gomphonema parvulum Kütz.
Gyrosigma kutzingii (Grun.) Cleve
Hantzchia amphioxys (Ehr.) Grun.
Melosira ambigua (Grun.) O. Müller
Melosira binderana Kg.
Melosira distans (Ehr.) Kütz.
  var. alpigena Grun.
Melosira granulata (Ehr.) Ralfs.
Melosira islandica O. Müller
Melosira varians C. A. Agardh
Meridion circulare (Grev.) C. A. Ag.
Navicula canalis Patrick
Navicula contenta Grun.
Navicula cryptocephala Kütz.
Navicula cuspidata Kutz.
Navicula hungarica Grun.
Navicula mutica Kütz.
Navicula notha Wallace
Navicula tripunctata (Mull.) Bory
Navicula viridula Kütz.
Nitzschia acicularis (Kütz.) W. Smith
Nitzschia apiculata (Gregory) Grun.
Nitzschia denticula Grun.
Nitzschia dissipata (Kütz.) Grun.
Nitzschia filliformis (W. Smith) Hust.
Nitzschia fonticola Grun.
Nitzschia holsatica Hust.
Nitzschia hungarica Grun.
Nitzschia linearis W. Smith
Nitzschia parvula Levis
Nitzschia sigma (Kütz.) W. Smith
Nitzschia sigmoidea (Ehr.) W. Smith
Nitzschia tryblionella Hantzsch
Pinnularia borealis Ehr.
Pleurosigma delicatulum W. Smith
Rhoicosphenia curvata (Kütz.) Grun.
Rhizosolenia eriensis H. L. Smith
Rhopalodia gibba (Ehr.) O. Müller
Stephanodiscus astraea (Ehr.) Grun.
  var. minutula (Kütz.) Grun.
Stephanodiscus dubius (Fricke) Hust.
Stephanodiscus hantzschii Grun.
Stephanodiscus niagarae Ehr.
Stephanodiscus niagarae Ehr.
  var. magnifica Fricke
Stephanodiscus tenuis Hust.
Surirella angustata Kütz.
Surirella brightwellii W. Smith
Surirella ovata Kütz.
Surirella striatula Turpin
Synedra acus Kütz.
Synedra pulchella Kütz.
Synedra nana Meister
Synedra tabulata (C. Ag.) Kütz.
Synedra ulna (Nitzsch) Ehr.
Synedra vaucheriae Kütz.
Tabellaria fenestrata (Lyngb.) Kütz.
Tabellaria flocculosa (Roth) Kütz.

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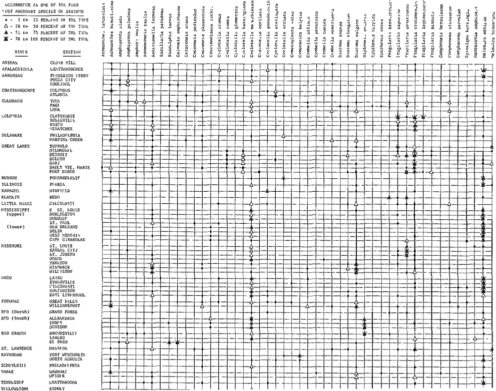
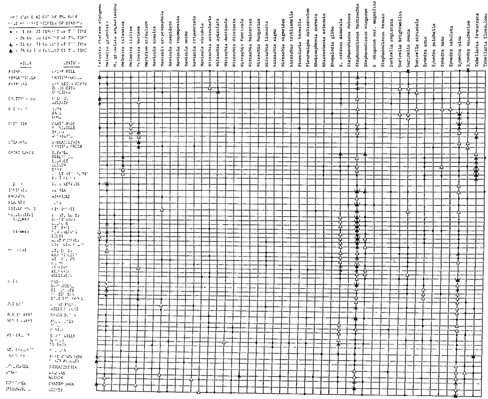
*Each species listed occurred one or more times in aggregate samplings as one of the four most abundant recorded at study stations in the 15 waterways involved.

Occurrence of Four Most Abundant Diatom Species



Occurrence of Four Most Abundant Diatom Species (continued)



Green Flagellates at 48 Stations

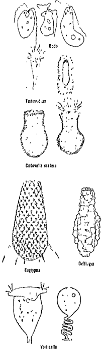
Because of the interest of some researchers in the use of green flagellate algae as potential indicators of organic enrichment, the compilation below is presented.

Semimonthly samples were used, beginning with the second sample in July 1960 through September 1961. Only those stations having uninterrupted sampling for this period are included. Average green flagellate counts for 48 stations for the 15-month period are shown below.

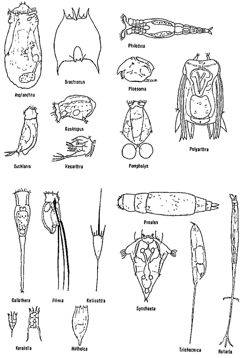
River	*Station*	*Counts/ ml*
Missouri	Yankton, S. Dak	2,050
Mississippi	Minneapolis, Minn	481
Arkansas	Ponca City, Okla	466
Ohio	E. Liverpool, Ohio	417
Missouri	Omaha, Nebr	375
Chattahoochee	Columbus, Ohio	258
Ohio	Evansville, Ind	252
Missouri	St. Joseph, Mo	226
Rio Grande	Brownsville, Tex	211
Ohio	Cincinnati, Ohio	196
Missouri	Kansas City, Kans	176
Kanawha	Winfield, W. Va	167
Yellowstone	Sidney, Mont	164
Missouri	St. Louis, Mo	162
Red River (S)	Index, Tex	145
Potomac	Great Falls, Md	139
Snake	Wawawai, Wash	138
Apalachicola	Chattahoochee, Fla	137
Colorado	Page, Ariz	134
Ohio	Huntington, W. Va	116
Missouri	Williston, N. Dak	112
Mississippi	Dubuque, Iowa	89
Savannah	Port Wentworth, Ga	83
Mississippi	Cape Girardeau, Mo	82
Mississippi	Delta, La	80
Animas	Cedar Hill, N. Mex	72
Mississippi	W. Memphis, Ark	69
Colorado	Loma, Colo	67
Arkansas	Pendleton Ferry, Ark	57
Hudson	Poughkeepsie, N.Y	51
Delaware	Martins Creek, Pa	51
Tennessee	Chattanooga, Tenn	51
Red River (S)	Denison, Tex	46
Colorado	Yuma, Ariz	40
Arkansas	Coolidge, Kans	37
Missouri	Bismarck, N. Dak	37
Colorado	Parker Dam, Ariz.-Calif	36
Columbia	Bonneville, Oreg	35
Columbia	Clatskanie, Oreg	33
Mississippi	New Orleans, La	31
Ohio	Cairo, Ill	29
Lake Michigan	Gary, Ind	18
Lake Erie	Buffalo, N.Y	15
Lake Huron	Port Huron, Mich	12
Lake Huron	Detroit, Mich	10
Lake Superior	Duluth, Minn	3
Lake Superior	Sault Ste. Marie, Mich	2
Colorado	Boulder City, Nev	2

MICROINVERTEBRATES

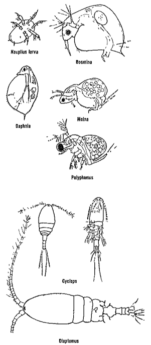
1-PROTOZOA



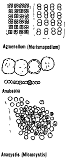
2-ROTIFERS

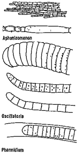


3-CRUSTACEA

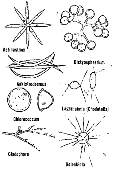


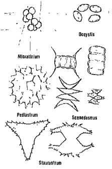
1-BLUE-GREEN ALGAE

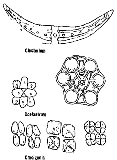




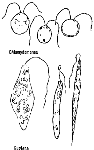
2-GREEN ALGAE

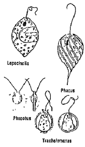




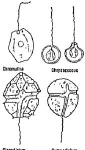


3-GREEN FLAGELLATES



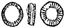


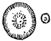
4-OTHER PIGMENTED FLAGELLATES

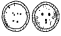


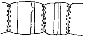
DIATOMS

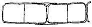
CENTRIC


Cyclotella meneghiniana

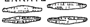

Cyclotella stelligera

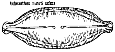

Cyclotella kutzingiana

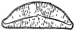

Melosira binderana

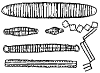

Melosira varians

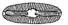
PENNATE

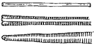

Achnanthes minutissima

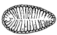

Caloneis amphisbaena

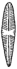

Cymbella tumida

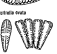

Diatoma vulgare

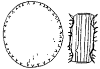

Diploneis smithii

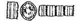

Synedra ulna

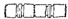

Surirella ovata

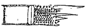


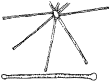

Gomphonema olivaceum

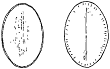

Stephanodiscus astraea

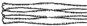

Stephanodiscus hantzschii

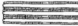

Melosira ambigua

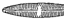

Melosira granulata

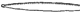

Asterionella formosa

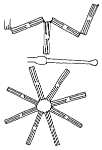

Cocconeis placentula


Fragilaria crotonensis

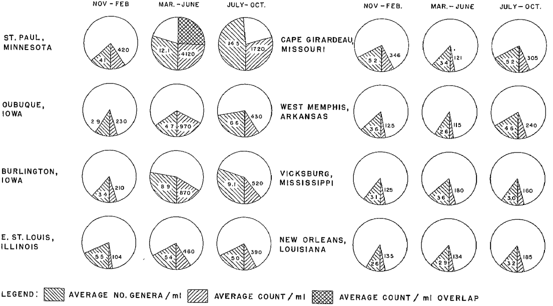

Fragilaria capucina


Navicula gracilis


Nitzschia palea

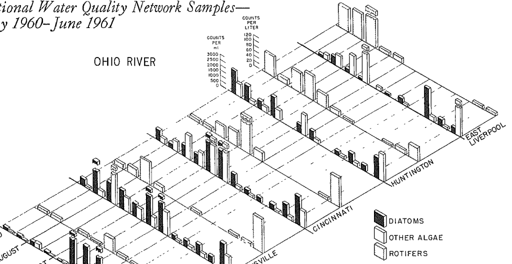

Tabellaria fenestrata

Planktonic Green Algae, Mississippi River—1959



Similarities or differences between sampling stations can be observed through separate reporting of the three major groups, diatoms, green flagellates, and rotifers. Charted above are planktonic green algae (nonflagellates) 4-month averages for the year 1959 at eight Mississippi River stations. The count decreases successively station by station downstream from St. Paul, Minn. to New Orleans, La. The average count per ml. for the whole year was 2,087 at St. Paul and 151 at New Orleans.

Relative Abundance of Diatoms, Other Algae and Rotifers, Ohio River National Water Quality Network Samples—May 1960–June 1961



Production by planktonic algae and consumption by planktonic rotifers has an important bearing on water quality. Wastes discharged into rivers may produce problems from overproduction by diatoms and other algae and underconsumption by microinvertebrates as the natural self-purification process takes place. To maintain water of high quality a balance of production and consumption is a desirable objective of stream management. A graphical presentation of this relationship for 5 sampling stations on the Ohio River is shown. Along the Ohio River the highest standing crops were observed during the late summer and early fall when flow rates are the lowest. Cincinnati, the midpoint station between the headwaters and river mouth, had the highest productivity of the 5 sampling stations.

*Average Number of Rotifers Per Liter**

July 1960 through June 1961

River	*Station*	*Count*
Animas	Cedar Hill, N. Mex	14.7
Apalachicola	Chattahoochee, Fla	34.2
Arkansas	Pendleton Ferry, Ark	11.9
	Ponca, City, Okla	39.0
	Coolidge, Kans	4.5
Chattahoochee	Columbus, Ga	125.2
	Atlanta, Ga	3.4
Colorado	Yuma, Ariz	2.0
	Page, Ariz	2.0
	Loma, Colo	0.6
Columbia	Clatskanie, Oreg	46.8
	Bonneville Dam, Wash.-Oreg	18.9
	Pasco, Wash	3.9
	Wenatchee, Wash	3.7
Delaware	Philadelphia, Pa	9.0
	Martins Creek, Pa	6.3
Great Lakes	Buffalo, N.Y	66.1
	Detroit, Mich	16.2
	Port Huron, Mich	22.2
	Gary, Ind	16.2
	Milwaukee, Wis	8.3
	Duluth, Minn	1.3
	Sault Ste. Marie, Mich	7.7
Hudson	Poughkeepsie, N.Y	8.0
Illinois	Peoria, Ill	242.2
Kanawha	Winfield, W. Va	6.1
Klamath	Keno, Oreg	161.3
Little Miami	Cincinnati, Ohio	85.2
Mississippi (Upper)	E. St. Louis, Ill	45.0
	Burlington, Iowa	18.0
	Dubuque, Iowa	42.0
	St. Paul, Minn	242.0
Mississippi (Lower)	New Orleans, La	0.5
	Delta, La	0.8
	W. Memphis, Ark	3.7
	Cape Girardeau, Mo	2.8
Missouri	St. Louis, Mo	0
	Kansas City, Kans	0
	St. Joseph, Mo	0.1
	Omaha, Nebr	0.5
	Yankton, S. Dak	27.3
	Bismarck, N. Dak	4.8
	Williston, N. Dak	0.9
Ohio	Cairo, Ill	3.0
	Evansville, Ind	71.0
	Cincinnati, Ohio	58.0
	Huntington, W. Va	28.0
	E. Liverpool, Ohio	13.0
Potomac	Great Falls, Md	2.9
	Williamsport, Md	1.4
Red (No.)	Grand Forks, N. Dak	175.9
Red (So.)	Alexandria, La	48.8
	Index, Tex	8.0
	Denison, Tex	6.0
Rio Grande	Brownsville, Tex	137.2
	Laredo, Tex	0.1
	El Paso, Tex	2.1
St. Lawrence	Massena, N.Y	16.0
Savannah	Port Wentworth, Ga	1.0
	N. Augusta, S.C	2.0
Schuylkill	Philadelphia, Pa	13.0
Snake	Wawawai, Wash	4.7
	Weiser, Idaho	18.8
Tennessee	Chattanooga, Tenn	22.5
Yellowstone	Sidney, Mont	0.8

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*Semimonthly samples from 65 Stations of the National Water Quality Network.

Explanation Of Sampling Station Charts

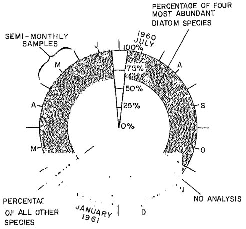
A. BAR GRAPH—Percent Occurrence and Relative Abundance of Diatoms.

The quality of surface waters at a given time may be indicated by the kinds and numbers of organisms they support. One effect of enrichment is a decrease in the diversity of the diatom species. The identification and relative abundance of the predominant diatom species is basic to the determination of their species diversity.

The bar graph, "Diatoms—Present Occurrence," lists those species of diatoms which appeared first, second, third or fourth in abundance in semimonthly samples taken during the period designated at 65 stations of the National Water Quality Network for the year beginning July 1, 1960. For those species in first or second place at any time, the graph presents the percent of the time they occurred as either first, second, third or fourth in abundance. For instance, in the Columbia River at Clatskanie, Oregon, *Synedra ulna* was the number one species 19 percent of the time, was in first or second place 32 percent of the time, was among the first three predominant species 51 percent of the time, and was among the first four 76 percent of the time. Species which never occurred in first or second place, but which did occur in third or fourth are listed, but their percent occurrence is not shown.

The percent occurrence in no way reflects the actual population density. A species second in abundance, for example, may be present in only small numbers; another may have occurred in large numbers in some samples, but because it was not among the first four, would not be listed.

Both the bar and circle graphs (see B, p. 25) deal with the same



DIATOMS COUNTS / ml.	CIRCLE SIZE
0-1000	SMALL
1001-3000	MEDIUM
3001-OR OVER	LARGE

sampling period. The bar graph includes species names and comprises one year's collection of data.

B. CIRCLE GRAPH—Diatoms, Species Diversity (See diagram at left).

While the bar graph is designed to show the percent occurrence and names of the four most abundant species for a year, the circle graph indicates the species diversity of diatoms at each of the 24 (semimonthly) sampling times for the year July 1960 through June 1961. Semimonthly samples are represented by radial lines extending from the perimeter of the circle. The short radial lines with month designations represent the second semimonthly samples normally taken during the third week of the month. The longer lines represent the first of the semimonthly samples. The months are recorded consecutively clockwise.

A total diatom population range is expressed in the size of the circle. Three circle sizes are used. A small circle (4 cm. in diameter) represents a diatom count of between zero and 1,000 per ml., a medium circle (6 cm. in diameter), between 1,001 and 3,000 per ml., and a large circle (8 cm.) above 3,001.

A total diatom population of any sample is represented as a percent by the radius designated for that sample. The percent of diatoms, other than the four most abundant species in a population, is determined by the distance from the center of the circle to a point on the radius. A quartile scale is given on a vertical radius of each circle. The central blank portion of the circle is formed by radially plotting percent of diatoms other than the four most abundant species Sections shaded by the smaller dots represent samples not analyzed. Species diversity is indicated by the extension of the white area from the center of circle. Thus a line drawn to connect these points on the 24 radii inscribes a figure or pattern which may be characteristic for each station. As the central clear area extends outward greater species diversity is indicated. Correspondingly, less diversity is indicated as the outer dark area increases.

The perimeter is divided into evenly spaced sampling times and each circle graph shows the fluctuations in species diversity between the 24 sampling times during the year. For example, species diversity is relatively great at Wawawai, Washington on the Snake River and relatively low at Grand Forks, North Dakota on the Red River. Many of the 65 circle graphs suggest seasonal patterns, with the least species diversity in late summer and fall. At Clatskanie, Oregon on the Columbia River, species diversity is greater during the winter months than the summer months.

C. LOGARITHMIC LINE GRAPH—Total Live Phytoplankton Counts.

Total live phytoplankton counts are plotted beginning with July 1959 for those stations that were in operation at that time. Counts are presented in a logarithmic scale on the vertical axis. The counts exclude the inert diatom shells. A summary of average seasonal total live phytoplankton counts is also presented. Seasonal periods averaged extend from June–September, October–January, and February–May.

D. TABLE OF ZOOPLANKTON

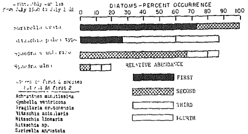
Four genera of rotifers were found to be very common in the major waterways of the United States by this study. The occurrence of these genera during the period July 1960 to July 1961 is presented with average counts per liter per sample. Column one presents the number of occurrences of all rotifers present in all samples. The second column gives the average count per liter based on all samples, whether or not rotifers were present.

Similar treatment is given copepods, cladocerans, nauplii, nematodes and other invertebrate metazoans.

E. TABLE OF MOST ABUNDANT GENERA OF ALGAE

The most abundant genera of algae are recorded in tabular form, the criterion for inclusion being occurrence in numbers 150 per ml. or more. The percent occurrence in these numbers is presented. The table is broken down into major groups (blue-greens, greens, green flagellates, other pigmented flagellates, diatoms—centric and pennate). This permits comparisons among these major groups of algae.

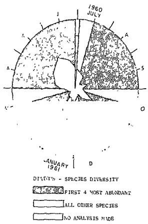
ANIMAS RIVER
CEDAR HILL, NEW MEXICO

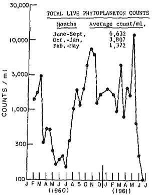


ZOOPLANKTON

Samples analyzed 19
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	12	14,7
Keratella	2	0,3
Polyarthra	2	0,1
Brachionus	1	0,1
Synchaeta	0	0
Other genera	7	14,2
Cladocerans.		
nauplii	2	0,1
copepods	0	0
cladocerans	0	0
Nematodes		0
Other invertebrate metazoans		0





TOTAL LIVE PHYTOPLANKTON COUNTS

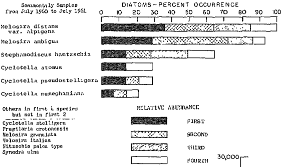
Months	Average count/ml.
June-Sept.	6,632
Oct.-Jan.	3,807
Feb.-May	1,372

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From Feb. 1960 to May 1961

Diatoms	
Pennate	
Achnanthes	14
Fragilaria	14
Gomphonema	7
Navicula	17
Nitzschia	35
Surirella	60
Synedra	71

APALACHICOLA RIVER
CHATTAHOOCHEE, FLORIDA



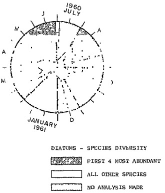
Others in first 4 species
but not in first 2

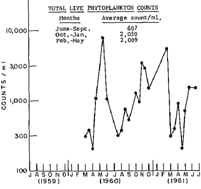
- Cyclotella stelligera
- Fragilaria crotonensis
- Melosira granulata
- Melosira italica
- Nitzschia palea type
- Synedra ulna

ZOOPLANKTON

Samples analyzed 18
Aug. 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	17	34.2
Keratella	16	10.7
Polyarthra	13	8.3
Brachionus	4	0.8
Synchaeta	8	2.4
Other genera	14	13.6
Crustaceans.		
nauplii	3	0.4
copepods	1	0.1
cladocerans	3	0.2
Nematodes		1.0
Other invertebrate metazoans		0





TOTAL LIVE PHYTOPLANKTON COUNTS

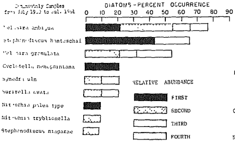
Months	Average count/ml.
June-Sept.	607
Oct.-Jan.	2,050
Feb.-May	2,009

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From March 1960 to May 1961

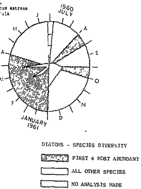
Green algae	
Scenedesmus	9
Green flagellates	
Phacotus	4
Trachelomonas	9
Other pigmented flagellates	
Chromulina	9
Diatoms	
Centric	
Cyclotella	28
Melosira	42
Stephanodiscus	28
Pennate	
Asterionella	14
Navicula	4
Nitzschia	4
Synedra	9

ARKANSAS RIVER
PENDLETON FERRY, ARKANSAS



Others in first 4 species but not in first 2

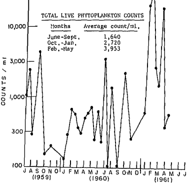
Amphiprora paludosa
Melosira distans var. alpigena
Navicula sp
Navicula sp.
Stephanodiscus astraea var. minutula



ZOOPLANKTON

Samples analyzed 13
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	6	11.9
Keratella	2	0
Polyarthra	4	0.5
Brachionus	2	10.9
Synchaeta	0	0
Other genera	2	0.5
Crustaceans.		
nauplii	1	0
copepods	2	0.5
cladocerans	1	0
Nematodes		5
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

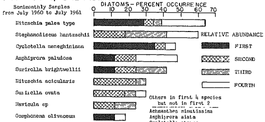
Months	Average count/ml.
June-Sept.	1,640
Oct.-Jan.	2,720
Feb.-May	3,953

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	3
Green algae	
Oocystis	3
Scenedesmus	3
Selenastrum	3
Stichococcus	3
Green flagellates	
Chlamydomonas	16
Euglena	3
Trachelomonas	11
Diatoms	
Centric	
Cyclotella	32
Melosira	16
Stephanodiscus	24
Pennate	
Amphiprora	3
Asterionella	3
Navicula	5
Nitzschia	11
Synedra	24

ARKANSAS RIVER
PONCA CITY, OKLAHOMA



Others in first 4 species but not in first 2

Achnanthes minutissima
Amphiprora alata
Cyclotella atomus
Navicula canalis
Navicula sp.
Nitzschia apiculata
Nitzschia hungarica
Nitzschia linearis
Nitzschia sp.
Synedra ulna

ZOOPLANKTON

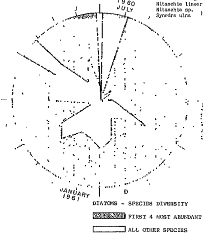
Samples analyzed 22
July 1960 to July 1961

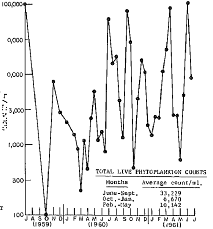
	Samples with Animals	Average count per liter per sample
Rotifers:	7	39.0
Keratella	4	0.6
Polyarthra	1	0.3
Brachionus	5	36.0
Synchaeta	2	0
Other genera	2	1.4
Crustaceans.		
nauplii	4	0.2
copepods	3	0.1
cladocerans	0	0
Nematodes		2.0

Other invertebrate metazoans none

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961	
Blue-green algae	
Agmenellum	3
Anacystis	5
Aphanizomenon	3
Gomphosphaeria	3
Oscillatoria	3
Phormidium	3
Green algae	
Actinastrum	16
Ankistrodesmus	11
Chlorella-type	3
Dictyosphaerium	3
Golenkinia	3
Lagerheimia	3
Micractinium	3
Oocystis	3
Pediastrum	5
Scenedesmus	24
Green flagellates	
Chlamydomonas	49
Euglena	5
Trachelomonas	5
Other pigmented flagellates	
Gymnodinium	3
Peridinium	3
Diatoms	
Centric	
Coscinodiscus	3
Cyclotella	73
Melosira	22
Stephanodiscus	39
Pennate	
Amphiprora	19
Gomphonema	8
Meridion	3
Opephora	3
Navicula	54
Nitzschia	54
Surirella	32
Synedra	35

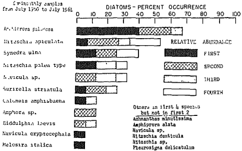




TOTAL LIVE PHYTOPLANKTON COUNTS

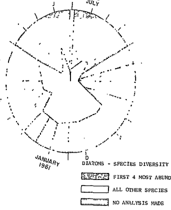
Months	Average count/ml.
June-Sept.	33,229
Oct.-Jan.	6,670
Feb.-May	10,142

ARKANSAS RIVER
COOLIDGE, KANSAS



Others in first 4 species
but not in first 2

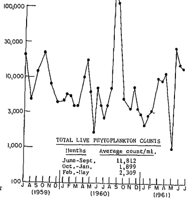
- Achnanthes minutissima
- Amphiprora alata
- Navicula sp.
- Nitzschia denticula
- Nitzschia sp.
- Pleurosigma delicatulum
- Surirella brightwellii
- Surirella ovata



ZOOPLANKTON

Samples analyzed 20
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	5	4.5
Keratella	0	0
Polyarthra	0	0
Brachionus	1	0
Synchaeta	0	0
Other genera	3	4.0
Crustaceans.		
nauplii	1	0.5
copepods	1	0
cladocerans	1	0
Nematodes		2
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	11,812
Oct.-Jan.	1,899
Feb.-May	2,309

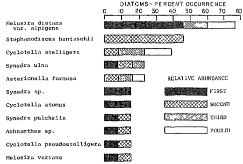
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Agmenellum	3
Aphanizomenon	3
Green algae	
Scenedesmus	6
Green flagellates	
Chlamydomonas	3
Other pigmented flagellates	
Peridinium	3
Diatoms	
Centric	
Cyclotella	18
Melosira	3
Pennate	
Achnanthes	3
Amphiprora	38
Amphora	9
Caloneis	3
Cocconeis	3
Gomphonema	9
Gyrosigna	3
Navicula	82
Nitzschia	62
Pleurosigma	6
Stauroneis	3
Surirella	32
Synedra	41

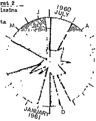
CHATTAHOOCHEE RIVER
COLUMBUS, GEORGIA

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Achnanthes minutissima
Melosira ambigua
Melosira granulata
Nitzschia sp.
Pinnularia sp.
Synedra nana
Melosira sp.



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

☐ ALL OTHER SPECIES

☐ NO ANALYSIS MADE

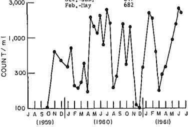
ZOOPLANKTON

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	16	125.2
Keratella	15	25.6
Polyarthra	13	37.9
Brachionus	2	0.1
Synchaeta	4	2.2
Other genera	12	59.4
Crustaceans.		
nauplii	6	3.2
copepods	6	1.9
cladocerans	8	5.6
Nematodes		2.0
Other invertebrate metazoans		0

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept	1,310
Oct.-Jan.	647
Feb.-May	682

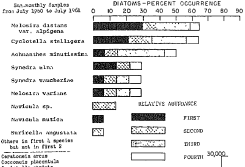


MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From October 1959 to May 1961

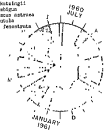
Blue-green algae	
Anacystis	3
Raphidiopsis	3
Green algae	
Scenedesmus	9
Green flagellates	
Chlamydomonas	9
Trachelomonas	6
Other pigmented flagellates	
Chromulina	18
Peridinium	3
Diatoms	
Centric	
Cyclotella	15
Melosira	15
Stephanodiscus	15
Pennate	
Asterionella	3
Fragilaria	3
Nitzschia	6
Synedra	9

CHATTAHOOCHEE RIVER
ATLANTA, GEORGIA



Others in first 4 species
but not in first 2

Ceratoneis arcus
Cocconeis placentula
Cyclotella striata
Cymbella bentricosa
Gyrosigma kutzingii
Melosira ambigua
Stephanodiscus astraea
var. minutula
Tabellaria fenestrata



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

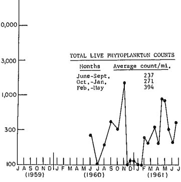
☐ ALL OTHER SPECIES

☐ NO ANALYSIS MADE

ZOOPLANKTON

Samples analyzed 22
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	13	3.4
Keratella	8	1.1
Polyarthra	5	1.0
Brachionus	1	0
Synchaeta	2	0.1
Other genera	11	1.2
Crustaceans		
nauplii	3	0.3
copepods	0	0
cladoceans	3	0.3
Nematodes		0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

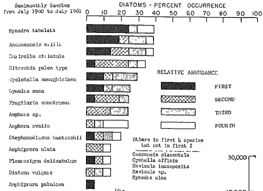
Months	Average count/ml.
June-Sept.	237
Oct.-Jan.	271
Feb.-May	394

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From June 1960 to June 1961

Green flagellates	
Phacotus	4
Other pigmented flagellates	
Chromulina	9
Diatoms	
Centric	
Cyclotella	18
Melosira	13
Stephanodiscus	4
Pennate	
Asterionella	13

COLORADO RIVER
YUMA, ARIZONA



Z O O P L A N K T O N

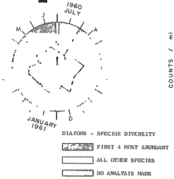
Samples analyzed 23
July 1960 to July 1961

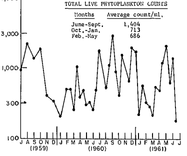
	Samples with Animals	Average count per liter per sample
Rotifers:	9	2.0
Keratella	5	0
Polyarthra	3	0
Brachionus	5	0.5
Synchaeta	5	0
Other genera	7	1.5
Crustaceans.		
nauplii	7	1
copepods	5	0
cladocerans	2	0
Nematodes		2
Other invertebrate metazoans		0

M O S T A B U N D A N T G E N E R A O F A L G A E

Percent frequency of counts 150 per ml. or more from May 1959 to May 1961

Blue-green algae	
Anacystis	5
Gomphosphaeria	3
Green algae	
Ankistrodesmus	3
Scenedesmus	5
Diatoms	
Centric	
Cyclotella	16
Stephanodiscus	11
Pennate	
Amphora	8
Anomoeoneis	13
Fragilaria	8
Navicula	11
Nitzschia	11
Synedra	29



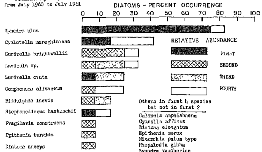


TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	1,404
Oct.-Jan.	713
Feb.-May	686

COLORADO RIVER
PAGE, ARIZONA

Semimonthly Samples
from July 1960 to July 1961



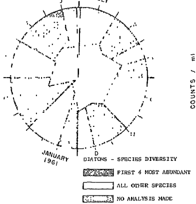
Others in first 4 species
but not in first 2

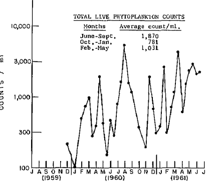
Caloneis amphisbaena
Cymbella affinis
Diatoma elongatum
Epithemia sorex
Nitzschia palea typo
Rhopalodia gibba
Synedra vaucheriae

ZOOPLANKTON

Samples analyzed 18
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	9	2.0
Keratella	5	0
Polyarthra	3	0
Brachionus	5	0.5
Synchaeta	5	2.0
Other genera	4	1.5
Crustaceans.		
nauplii	7	1.0
copepods	5	0
cladocerans	2	0
Nematodes		0
Other invertebrate metazoans		0





TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	1,870
Oct.-Jan.	781
Feb.-May	1,031

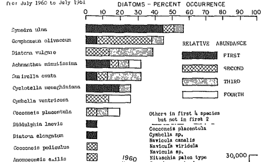
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From Dec. 1959 to May 1961

Green Algae	
Ankistrodesmus	3
Scenedesmus	9
Green flagellates	
Chlamydomonas	6
Diatoms	
Centric	
Cyclotella	22
Stephanodiscus	19
Pennate	
Cymbella	6
Diatoma	6
Epithemia	3
Fragilaria	6
Gomphonema	3
Navicula	9
Nitzschia	12
Surirella	9
Synedra	38

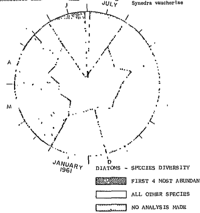
COLORADO RIVER
LOMA, COLORADO

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Cocconeis placentula
Cymbella sp.
Navicula canalis
Navicula viridula
Navicula sp.
Nitzschia palea type
Synedra vaucheriae

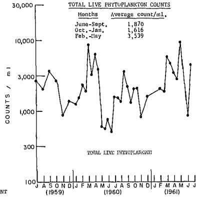


DIATOMS - SPECIES DIVERSITY

ZOOPLANKTON

Samples analyzed 19
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	6	0.6
Keratella	0	0
Polyarthra	0	0
Brachionus	0	0
Synchaeta	1	0.6
Other genera	3	0.6
Crustaceans:		
nauplii	0	0
copepods	0	0
cladocerans	0	0
Nematodes		1
Other invertebrate metazoans		0



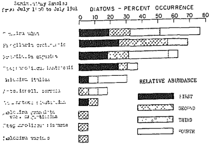
TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	1,870
Oct.-Jan.	1,616
Feb.-May	3,539

MOST ABUNDANT GENERA OF ALGAE

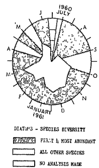
Percent frequency of counts 150 per ml. or more From May 1959 to May 1961	
Blue-green algae	
Anacystis	2
Green algae	
Tetradesmus	2
Diatoms	
Centric	
Cyclotella	30
Stephanodiscus	5
Pennate	
Achnanthes	22
Cocconeis	15
Cymbella	52
Diatoma	36
Fragilaria	2
Gomphonema	52
Navicula	69
Nitzschia	16
Surirella	19
Synedra	75
Stauroneis	2
Opephora	2

COLUMBIA RIVER
CLATSKANIE, OREGON



Others in first 4 species but not in first 2

Fragilaria construens
Melosira ambigua
Melosira granulata
Stephanodiscus astraea var. minutula
Synedra sp.



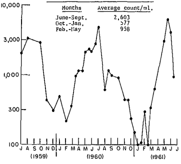
DIATOMS - SPECIES DIVERSITY

ZOOPLANKTON

Samples analyzed 22
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	13	46.8
Keratella	11	23.0
Polyarthra	9	12.0
Brachionus	5	2.7
Synchaeta	7	0.6
Other genera	6	8.5
Crustaceans		
nauplii	7	1.0
copepods	8	0.6
cladocerans	8	1.0
Nematodes		0
Other invertebrate metazoans		0

TOTAL LIVE PHYTOPLANKTON COUNTS



Months	Average count/ml.
June-Sept.	2,603
Oct.-Jan.	577
Feb.-May	958

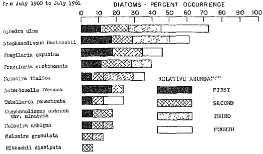
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml, or more From May 1959 to May 1961

Blue-green algae	
Anacystis	3
Phormidium	3
Green algae	
chlorella-type	3
Stichococcus	6
Diatoms	
Centric	
Cyclotella	19
Melosira	32
Stephanodiscus	31
Pennate	
Achnanthes	6
Asterionella	19
Fragilaria	25
Navicula	9
Synedea	19
Tabellaria	6

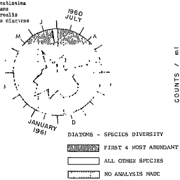
COLUMBIA RIVER
BONNEVILLE, OREGON

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Achnanthes minutissima
Melosira varians
Pinnularia borealis
Stephanodiscus niagarae
Synedra acus



ZOOPLANKTON

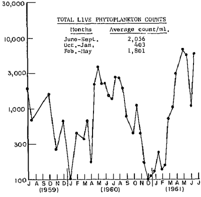
Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter/sample
Rotifers	10	18.9
Keratella	10	12.0
Polyarthra	6	3.0
Brachionus	4	0.8
Synchaeta	2	0.6
Other genera	8	3.3
Crustaceans:		
nauplii	3	0
copepods	2	0
cladocerans	2	0
Other invertebrate metazoans	0	

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
from May 1959 to May 1961

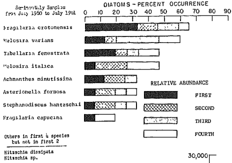
Blue-green algae	
Anacystis	3
Phormidium	6
Diatoms	
Centric	
Cyclotella	23
Melosira	26
Stephanodiscus	29
Pennate	
Achnanthes	3
Asterionella	31
Diatoma	3
Fragilaria	39
Navicula	11
Nitzschia	6
Synedra	29
Tabellaria	11



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	2,056
Oct.-Jan.	403
Feb.-May	1,801

COLUMBIA RIVER
PASCO, WASHINGTON



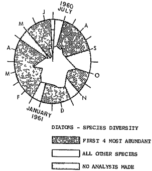
Others in first 4 species but not in first 2

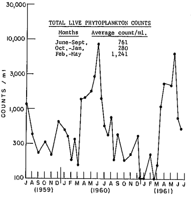
Nitzschia dissipata
Nitzschia sp.

ZOOPLANKTON

Samples analyzed 19
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	14	3.9
Keratella	6	0.8
Polyarthra	7	1.0
Brachionus	2	0
Synchaeta	3	3.9
Other genera	8	3.1
Crustaceans.		
nauplii	2	0
copepods	2	0
cladocerans	1	0
Nematodes		0
Other invertebrate metazoans		0





TOTAL LIVE PHYTOPLANKTON COUNTS

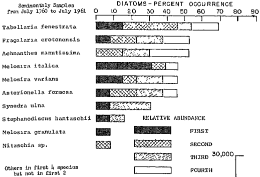
Months	Average count/ml.
June-Sept.	761
Oct.-Jan.	280
Feb.-May	1,241

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961

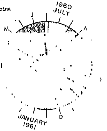
Blue-green algae	
Phormidium	3
Diatoms	
Centric	
Cyclotella	6
Melosira	31
Stephanodiscus	11
Pennate	
Achnanthes	9
Asterionella	31
Fragilaria	14
Nitzschia	9
Synedra	23
Tabellaria	34

COLUMBIA RIVER
WENATCHEE, WASHINGTON



Others in first 4 species but not in first 2

Achnanthes sp.
Fragilaria capucina



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

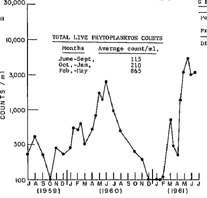
☐ ALL OTHER SPECIES

▨ NO ANALYSIS MADE

ZOOPLANKTON

Samples analyzed 17
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	8	3.7
Keratella	6	1.7
Polyarthra	1	0
Brachionus	0	0
Synchaeta	1	0
Other genera	8	2.7
Crustaceans:		
nauplii	1	0
copepods	0	0
cladocerans	2	0
Nematodes		0
Othar invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

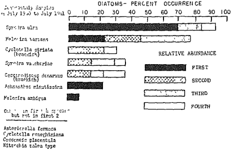
Months	Average count/ml.
June-Sept.	115
Oct.-Jan.	210
Feb.-May	865

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
From May 1959 to May 1961

Diatoms	
Centric	
Cyclotella	7
Melosira	10
Pennate	
Achnanthes	10
Asterionella	31
Fragilaria	7
Nitzschia	3
Synedra	14
Tabellaria	45

DELAWARE RIVER
PHILADELPHIA, PA



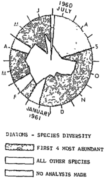
ZOOPLANKTON

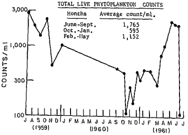
Samples analyzed 18
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	6	9.0
Keratella	2	0.
Polyarthra	1	1.0
Brachionus	1	0.8
Synchaeta	1	0
Other genera	5	7.2
Crustaceans.		
nauplii	0	0
copepods	0	0
cladocerans	0	0
Nematodes		1.0
Other invertebrate metazoans		0

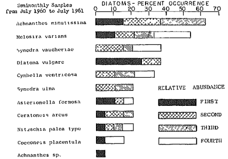
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961	
Blue-green algae	
Anacystis	14
Green algae	
Actinastrum	5
Ankistrodesmus	5
Chlorella-type	5
Oocystis	5
Scenedesmus	14
Green flagellates	
Chlamydomonas	5
Other pigmented flagellates	
Ochromonas	5
Diatoms	
Centric	
Cyclotella	33
Melosira	10
Pennate	
Asterionella	5
Fragilaria	5
Gomphonema	5
Navicula	5
Synedra	52



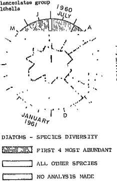


DELAWARE RIVER
MARTINS CREEK, PENNSYLVANIA



Others in first 4 species but not in first 2

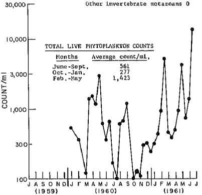
Navicula cryptocephala
Navicula tripunctata
Nitzschia lanceolatae group
Synedra pulchella



ZOOPLANKTON

Samples analyzed 23
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	16	6.3
Keratella	10	1.6
Polyarthra	5	0.4
Brachionus	1	0
Synchaeta	5	0.4
Other genera	12	3.9
Crustaceans:		
nauplii	2	0.1
copepods	3	0.1
cladocerans	1	0.1
Nematodes		2
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	561
Oct.-Jan.	277
Feb.-May	1,423

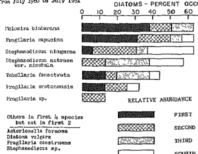
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Green algae	
Scenedesmus	6
Green flagellates	
Chlamydomonas	3
Chlorobranchis	3
Other pigmented flagellates	
Chromulina	3
Diatoms	
Centric	
Cyclotella	6
Melosira	9
Stephanodiscus	3
Pennate	
Achnanthes	6
Asterionella	16
Ceratoneis	6
Cocconeis	3
Cymbella	13
Diatoma	16
Fragilaria	6
Navicula	6
Nitzschia	3
Synedra	25

GREAT LAKES, LAKE ERIE, NIAGARA RIVER
BUFFALO, NEW YORK

Semimonthly Samples
from July 1960 to July 1961



Z O O P L A N K T O N

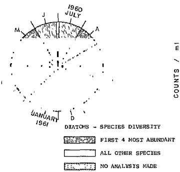
Samples analyzed 23
July 1960 to July 1961

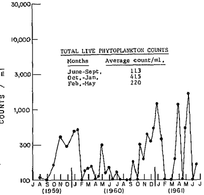
	Samples with Animals	Average count per liter per sample
Rotifers	23	66.1
Keratella	23	27.5
Polyarthra	20	30.0
Brachionus	4	0.6
Synchaeta	5	1.0
Other genera	18	6.9
Crustaceans:		
nauplii	11	4.5
copepods	11	3.5
cladocerans	10	4.9
Nematodes		1.0
Other invertebrate metazoans		0

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Diatoms	
Centric	
Cyclotella	5
Melosira	7
Stephanodiscus	17
Pennate	
Asterionella	2
Diatoma	2



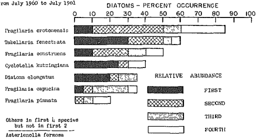


TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	113
Oct.-Jan.	415
Feb.-May	220

GREAT LAKES, LAKE HURON, DETROIT RIVER
DETROIT, MICHIGAN

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Asterionella formosa
Cyclotella comta
Cyclotella ocellata
Melosira islandica
Melosira varians
Synedra acus
Synedra ulna

ZOOPLANKTON

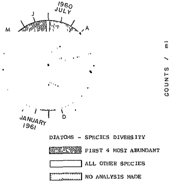
Samples analyzed 23
July 1960 to July 1961

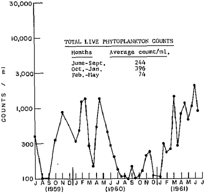
	Samples with Animals	Average count per liter per sample
Rotifers:	19	6.3
Keratella	14	3.4
Polyarthra	4	0.9
Brachionus	4	0.8
Synchaeta	5	0.4
Other genera	13	0.8
Crustaceans:		
nauplii	6	0.6
copepods	13	0.9
cladocerans	4	1.9
Nematodes		1.
Other invertebrate metazoans		0

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
from May 1959 to May 1961

Diatoms	
Centric	
Cyclotella	5
Stephanodiscus	5
Pennate	
Asterionella	17
Diatoma	17
Fragilaria	12
Synedra	12
Tabellaria	10

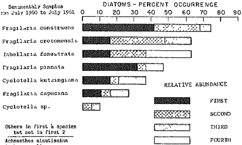




TOTAL LIVE PHYTOPLANKTON COUNTS

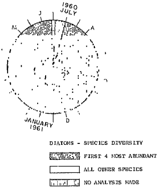
Months	Average count/ml.
June-Sept.	244
Oct.-Jan.	396
Feb.-May	74

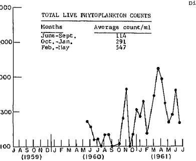
GREAT LAKES, LAKE HURON, ST CLAIR RIVER
PORT HURON, MICHIGAN



Others in first 4 species but not in first 2

- Achnanthes minutissima
- Amphora ovalis
- Cyclotella ocellata
- Diatoma elongatum
- Diatoma vulgare
- Fragilaria leptostauron
- Synedra acus





TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml
June-Sept.	114
Oct.-Jan.	291
Feb.-May	547

ZOOPLANKTON

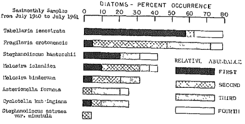
Samples analyzed 24
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	20	22.2
Keratella	14	12.0
Polyarthra	9	4.5
Brachionus	5	0.5
Synchaeta	4	0.5
Others	16	4.7
Crustacea:		
Nauplii	11	2.3
Copepods	16	6.1
Cladocera	11	2.3
Other invertebrate metazoans		0

MOST ABUNDANT GENERA OF ALGAE

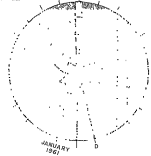
	Percent frequency of counts 150 per ml. or more From May 1960 to May 1961
Diatoms	
Centric	
Cyclotella	4
Stephanodiscus	4
Pennate	
Asterionella	8
Diatoma	4
Fragilaria	13

GREAT LAKES, LAKE MICHIGAN
GARY, INDIANA



Others in first 4 species but not in first 2

Cyclotella comta
Diatoma vulgare
Fragilaria capucina
Fragilaria sp.
Melosira ambigua
Synedra ulna

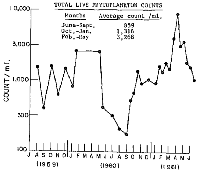


DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

☐ ALL OTHER SPECIES

☐ NO ANALYSIS MADE



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count /ml.
June-Sept.	859
Oct.-Jan.	1,316
Feb.-May	3,268

ZOOPLANKTON

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	17	16.2
Keratella	11	6.8
Polyarthra	5	0.7
Brachionus	5	1.6
Synchaeta	2	0
Other genera	15	7.1
Crustaceans:		
nauplii	6	0
copepods	7	0
cladocerans	6	2.7
Nematodes		0
Other invertebrate metazoans		0

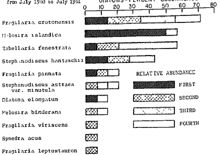
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	3
Green algae	
Oocystis	3
Diatoms	
Centric	
Cyclotella	25
Melosira	56
Rhizosolenia	3
Stephanodiscus	21
Pennate	
Asterionella	46
Diatoma	3
Fragilaria	18
Nitzschia	3
Synedra	32
Tabellaria	54

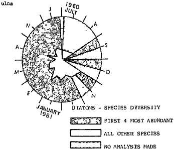
GREAT LAKES, LAKE MICHIGAN
MILWAUKEE, WISCONSIN

Semimonthly Samples from July 1960 to July 1961



Others in first 4 species but not in first 2

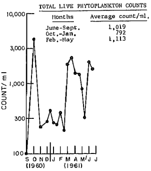
- Asterionella formosa
- Cyclotella comta
- Cyclotella kutzingiana
- Fragilaria capucina
- Stephanodiscus "michiganiana"
- Tabellaria flocculosa
- Synedra ulna



ZOOPLANKTON

Samples analyzed 19
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	16	8.3
Keratella	11	2.2
Polyarthra	5	2.2
Brachionus	8	1.1
Synchaeta	4	0.7
Other genera	13	2.1
Crusraceans		
nauplii	9	2.1
copepods	13	2.9
cladocerans	6	0.8
Nematodes		0
Other invertebrate motazoans		0.8



TOTAL LIVE PHYTOPLANKTON COUNTS

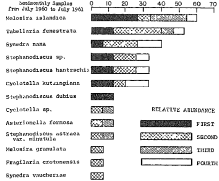
Months	Average count/ml.
June-Sept.	1,019
Oct.-Jan.	792
Feb.-May	1,113

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
From Sept. 1960 to Sept. 1961

Diatoms	
Centric	
Cyclotella	15
Melosira	15
Stephanodiscus	55
Pennate	
Fragilaria	10
Synedra	20
Tabellaria	10

GREAT LAKES, LAKE SUPERIOR
DULUTH, MINNESOTA

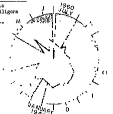


ZOOPLANKTON	Samples with Animals	Average count per liter per sample
Samples analyzed 24 July 1960 to July 1961		
Rotifers:	8	1.3
Keratella	8	0.3
Polyarthra	1	0
Brachionus	0	0
Synchaeta	2	0.2
Others	5	0.8
Crustaceans:		
nauplii	3	0.3
copepods	4	0.3
cladocerans	2	0.2
Other invertebrate metazoans		0

THERE WERE NO GENERA OF ALGAE WITH COUNTS OVER 150 per ml.

Others in first 4 species but not in first 2

Cyclotella comta
Cyclotella stelligora
Fragilaria sp.
Melosira ambig
Rhizosolenia
Synedra acus
Synedra sp.

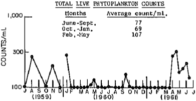


DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

☐ ALL OTHER SPECIES

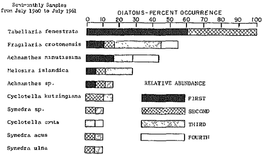
☐ NO ANALYSIS MADE



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	77
Oct.-Jan.	69
Feb.-May	107

GREAT LAKES, LAKE SUPERIOR, ST MARY'S RIVER
SAULT STE. MARIE, MICHIGAN



THERE WERE NO GENERA OF
ALGAE WITH COUNTS OVER
150 per ml.

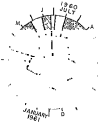
Others in first 4 species
but not in first 2

- Amphiphora ovalis
- Asterionella formosa
- Cocconeis placentula
- Cyclotella glomerata
- Cyclotella sp.
- Cymbella sp.
- Fragilaria construens
- Rhizosolenia eriensis
- Stephanodiscus hantzschii
- Synedra nana
- Synedra sp.

Z O O P L A N K T O N

Samples analyzed 23
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	15	7.7
Keratella	14	2.3
Polyarthra	6	1.3
Brachionus	3	0.1
Synchaeta	4	0.4
Other genera	9	4.4
Crustaceans:		
nauplii	5	0.9
copepods	6	0.9
cladocerans	3	0.2
Other invertebrate metazoa	0	

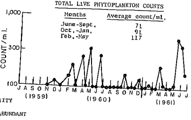


DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

☐ ALL OTHER SPECIES

☐ NO ANALYSIS MADE

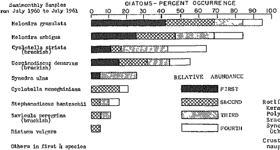


TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	71
Oct.-Jan.	91
Feb.-May	117

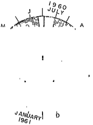
HUDSON RIVER
POUGHKEEPSIE, NEW YORK

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Melosira distans var. alpigena
Melosira varians



DIATOMS - SPECIES DIVERSITY

▩ FIRST 4 MOST ABUNDANT

☐ ALL OTHER SPECIES

⬚ NO ANALYSIS MADE

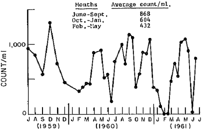
ZOOPLANKTON

Samples analyzed 22
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	17	8.0
Keratella	12	2.1
Polyarthra	3	0.2
Brachionus	4	0.2
Synchaeta	2	0.1
Other genera	14	5.4
Crustaceans		
nauplii	7	0.6
copepods	5	0.6
cladocerans	5	0.6
Nematodes		2
Other invertebrate metazoans		0

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	868
Oct.-Jan.	604
Feb.-May	432

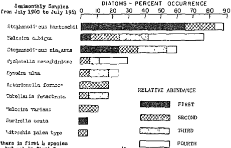


MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	3
Green algae	
Scenedesmus	6
Tetrastrum	3
Diatoms	
Centric	
Coscinodiscus	6
Cyclotella	26
Melosira	31
Stephanodiscus	3
Pennate	
Synedra	9

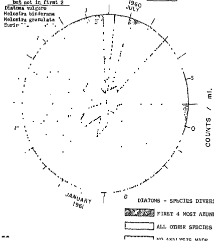
ILLINOIS RIVER
PEORIA, ILLINOIS

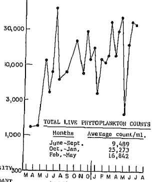


ZOOPLANKTON

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	19	242.2
Keratella	14	84.
Polyarthra	13	52.
Brachionus	4	33.
Synchaeta	12	11.
Other genera	17	85.
Crusraceans:		
nauplii	10	23.
copepods	8	7.
cladocerans	3	4.
Nematodes		2.
Other invertebrate metazoans		0





TOTAL LIVE PHYTOPLANKTON COUNTS

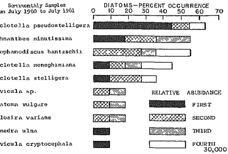
Months	Average count/ml.
June-Sept.	9,489
Oct.-Jan.	25,273
Feb.-May	16,842

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From March 1960 to May 1961

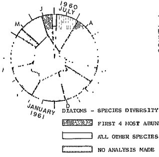
Blue-green algae	
Anacystis	8
Phormidium	4
Green algae	
Actinastrum	33
Ankistrodesmus	29
Chlorella-type	8
Chlorococcum	4
Golenkinia	13
Micractinium	8
Scenedesmus	38
Westella	4
Green flagellates	
Chlamydomonas	79
Euglena	33
Gonium	4
Lepocinclis	8
Trachelomonas	46
Other pigmented flagellates	
Chromulina	33
Diatoms	
Centric	
Cyclotella	50
Melosira	42
Stephanodiscus	92
Pennate	
Asterionella	25
Diatoma	13
Fragilaria	4
Gomphonema	4
Navicula	13
Nitzschia	50
Surirella	8
Synedra	33

KANAWHA RIVER
WINFIELD DAM, WEST VIRGINIA



Others in first 4 species but not in first 2

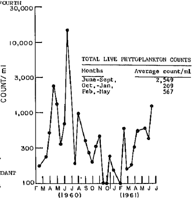
Fragilaria crotonensis
Nitzschia palea type
Synedra vaucheriae



ZOOPLANKTON

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	5	6.1
Keratella	1	0.1
Polyarthra	1	0.1
Brachionus	2	0.1
Synchaeta	0	0
Others	2	5.8
Crustacea:		
Nauplii	0	0
Copepods	0	0
Gladocera	0	0
Nematodes		1
Other invertegrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml
June-Sept.	2,549
Oct.-Jan.	209
Feb.-May	567

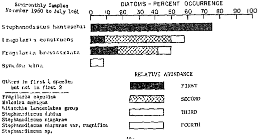
MOST ABUNDANT GENERA OF ALGAE

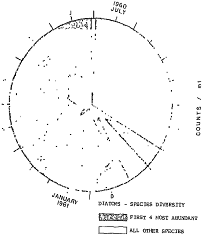
Percent frequency of counts 150 per ml. or more From February 1960 to May 1961

Green algae	
Ankistrodesmus	7
Chlorococcum	3
Scenedesmus	3
Stigeoclonium	3
Green flagellates	
Chlamydomonas	11
Other pigmented Flagellates	
Chromulina	3
Diatoms	
Centric	
Cyclotella	15
Stephanodiscus	7

KLAMATH RIVER
KENO, OREGON

Semimonthly Samples
November 1960 to July 1961

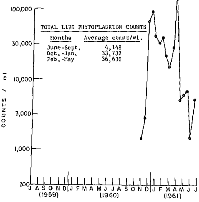




ZOOPLANKTON

Samples analyzed 18
Nov. 1960 to August 1961

	Samples with Animals	Average count per liter per sample
ROTIFERS	18	161.3
Keratella	17	39.8
Polyarthra	13	39.8
Brachionus	14	28.2
Synchaeta	10	2.1
Other genera	15	51.4
Crustaceans.		
nauplii	8	7.8
copepods	7	2.9
cladocerans	4	2.3
Nematodes		0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

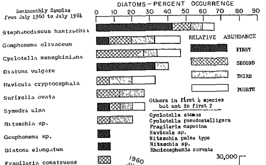
Months	Average count/mL.
June-Sept.	4,148
Oct.-Jan.	33,732
Feb.-May	36,630

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From Nov. 1960 to August 1961

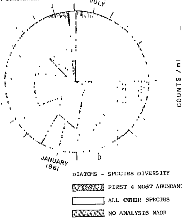
Blue-green algae	
Anacystis	16
Phormidium	5
Green algae	
Dictyosphaerium	11
Scenedesmus	11
Green flagellates	
Chlamydomonas	5
Trachelomonas	27
Other pigmented flagellates	
Chromulina	11
Diatoms	
Centric	
Cyclotella	11
Melosira	5
Stephanodiscus	100
Pennate	
Asterionella	5
Cymbella	5
Diatoma	6
Fragilaria	61
Navicula	15
Nitzschia	27
Surirella	5
Synedra	16

LITTLE MIAMI RIVER
CINCINNATI, OHIO



Others in first 4 species but not in first 2

- Cyclotella atomus
- Cyclotella pseudostelligera
- Fragilaria capucina
- Navicula sp.
- Nitzschia palea type
- Nitzschia sp.
- Rhoicosphenia curvata



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

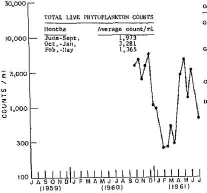
☐ ALL OTHER SPECIES

▨ NO ANALYSIS MADE

ZOOPLANKTON

Samples analyzed 20
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	12	85.2
Keratella	4	4.0
Polyarthra	1	0.1
Brachionus	3	59.5
Synchaeta	4	1.4
Others	9	20.2
Crustacea:		
Nauplii	2	0.7
Copepods	0	0
Cladocera	0	0
Nematodes		1
Other invertebrate metazoans		0



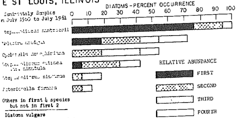
TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml
June-Sept.	1,973
Oct.-Jan.	3,281
Feb.-May	1,365

MOST ABUNDANT GENERA OF ALGAE

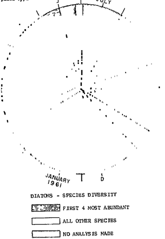
Percent frequency of counts 150 per ml. or more October 1960 to September 1961	
Green algae	
Lagerheimia	5
Oocystis	5
Green flagellates	
Chlamydomonas	20
Phacotus	5
Trachelomonas	15
Other pigmented flagellates	
Chrysococcus	5
Diatoms	
Centric	
Cyclotella	35
Melosira	5
Stephanodiscus	45
Pennate	
Diatoma	10
Navicula	20
Nitzschia	20
Surirella	5
Synedra	15

MISSISSIPPI RIVER
E ST LOUIS, ILLINOIS



Others in first 4 species but not in first 2

- Diatoma vulgare
- Melosira distans var. alpigena
- Melosira granulata var. angustissima
- Nitzschia palea type



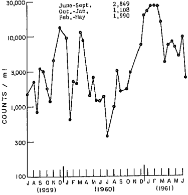
ZOOPLANKTON

Samples analyzed 19
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	15	45.0
Keratella	11	21.0
Polyarthra	6	4.0
Brachionus	9	8.0
Synchaeta	5	2.0
Other genera	11	10.0
Crustaceans:		
nauplii	4	0.3
copepods	5	0.8
cladocerans	2	0.1
Nematodes		3.0
Other invertebrate metazoans		0

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	2,849
Oct.-Jan.	1,108
Feb.-May	1,990



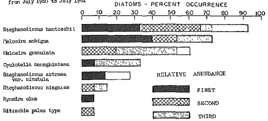
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	5
Green algae	
Actinastrum	2
Ankistrodesmus	5
Scenedesmus	5
Green flagellates	
Chlamydomonas	17
Trachelomonas	7
Diatoms	
Centric	
Coscinodiscus	2
Cyclotella	38
Melosira	67
Stephanodiscus	89
Pennate	
Asterionella	19
Gyrosigma	2
Navicula	10
Nitzschia	14
Surirella	2
Synedra	38

MISSISSIPPI RIVER
BURLINGTON, IOWA

Seminonthly Samples
from July 1960 to July 1961



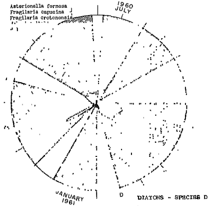
ZOOPLANKTON

Samples analyzed 18
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifera:	14	18,0
Keratella	13	6,
Polyarthra	10	2,
Brachionus	9	8,
Synchaeta	5	2,
Other genera	9	0
Crustaceans,		
nauplii	4	0,3
copepods	5	0,8
cladocerans	2	0,5
Nematodes		2,
Other invertebrate metazoans		0

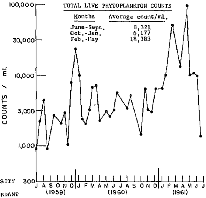
Others in first 4 species
but not in first 2

Asterionella formosa
Fragilaria capucina
Fragilaria crotonensis



DIATOMS - SPECIES DIVERSITY

▨	FIRST 4 MOST ABUNDANT
☐	ALL OTHER SPECIES
▥	NO ANALYSIS MADE



TOTAL LIVE PHYTOPLANKTON COUNTS

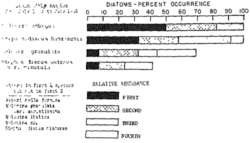
Months	Average count/ml.
June-Sept.	8,321
Oct.-Jan.	6,177
Feb.-May	18,383

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	16
Oscillatoria	3
Green algae	
Actinastrum	3
Ankistrodesmus	5
Chlorella-type	5
Micractinium	3
Oocystis	3
Scenedesmus	16
Stichococcus	3
Green flagellate algae	
Chlamydomonas	21
Phacus	3
Trachelomonas	5
Other pigmented flagellates	
Chromulina	3
Diatoms	
Centric	
Cyclotella	29
Melosira	66
Stephanodiscus	100
Pennate	
Asterionella	11
Cymatopleura	3
Diatoma	3
Fragilaria	5
Gyrosigma	3
Navicula	8
Nitzschia	3
Surirella	5
Synedra	29

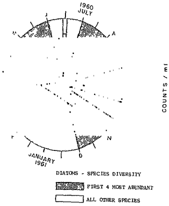
MISSISSIPPI RIVER
DUBUQUE, IOWA

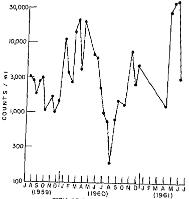


ZOOPLANKTON

Samples analyzed 12
July 1960 to July 1961

	Samples with Animals	Average Count per liter per sample
Rotifers:	10	42
Keratella	8	30
Polyarthra	6	2
Brachionus	4	5
Synchaeta	3	1
Other genera	7	4
Crustaceans:		
nauplii	8	5.9
copepods	7	3.8
cladocerans	5	0.5
Nematodes		1
Other invertebrate metazoans		0





TOTAL LIVE PHYTOPLANKTON COUNTS

Months   Average count/ml.

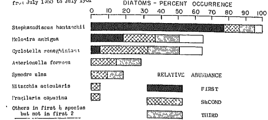
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anabaena	5
Anacystis	13
Aphanizomenon	8
Green algae	
chlorella-type	
Scenedesmus	3
Schroderia	3
Stichococcus	3
Green flagellates	
Chlamydomonas	18
Trachelomonas	3
Other pigmented flagellates	
Chromulina	3
Diatoms	
Centric	
Cyclotella	5
Melosira	66
Stephanodiscus	87
Pennate	
Asterionella	5
Diatoma	3
Fragilaria	8
Navicula	5
Nitzschia	5

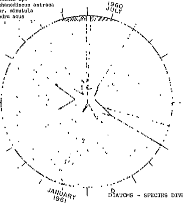
MISSISSIPPI RIVER
ST. PAUL, MINNESOTA

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Cocconeis pediculus
Cyclotella atomus
Melosira sp.
Nitzschia sp.
Stephanodiscus astraea
var. minutula
Synedra acus



DIATOMS - SPECIES DIVERSITY

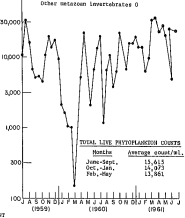
▨ FIRST 4 MOST ABUNDANT

☐ ALL OTHER SPECIES

ZOOPLANKTON

Samples analyzed 22
July 1960 to July 1961

	Samples with Animals	Average count per liter/sample
Rotifers:	23	242
Keratella	23	56
Polyarthra	19	28
Brachionus	5	52
Synchaeta	14	16
Other genera	20	90
Crustacea:		
nauplii	16	15
copepods	12	16
cladocerans	8	3
Nematodes		1
Other metazoan invertebrates		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	15,615
Oct.-Jan.	14,073
Feb.-May	13,861

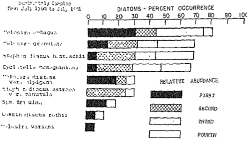
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Agmenellum	14
Anacystis	46
Aphanizomenon	7
Gomphosphaeria	2
Lyngbya	2
Oscillatoria	23
Phormidium	5
Green algae	
Actinastrum	14
Ankistrodesmus	34
Chlorella-type	14
Crucigenia	5
Golenkinia	20
Micractinium	14
Oocystis	2
Palmellococcus	2
Scenedesmus	57
Staurastrum	2
Stichococcus	5
Green flagellates	
Chlamydomonas	45
Euglena	7
Trachelomonas	23
Other pigmented flagellates	
Chromulina	23
Cryptomonas	2
Dinobryon	5
Gymnodinium	5
Diatoms	
Centric	
Cyclotella	34
Melosira	45
Stephanodiscus	95
Pennate	
Asterionella	9
Cocconeis	2
Cymatopleura	2
Diatoma	2
Navicula	18
Nitzschia	30
Synedra	43

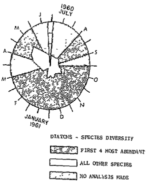
MISSISSIPPI RIVER
NEW ORLEANS, LOUISIANA

Semi-monthly Samples
from July 1960 to July 1961



Others in first 4 species but not in first 2

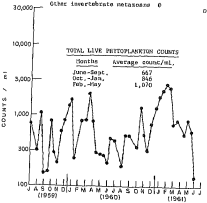
Melosira granulata var. angustissima
Melosira italica
Stephanodiscus niagarae
Synedra acus



ZOOPLANKTON

Samples analyzed 24
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	6	0.5
Keratella	4	0.4
Polyarthra	1	0
Brachionus	2	0.1
Synchaeta	0	0
Other genera	3	0
Crustaceans		
nauplii	1	0.1
copepods	1	0
cladocerans	1	0
Nematodes		3
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	667
Oct.-Jan.	846
Feb.-May	1,070

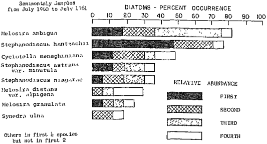
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Green algae	
chlorella-type	2
Scenedesmus	2
Diatoms	
Centric	
Cyclotella	9
Melosira	47
Stephanodiscus	51
Pennate	
Synedra	4

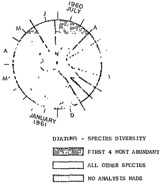
MISSISSIPPI RIVER DELTA, LOUISIANA

Semimontnly Samples from July 1960 to July 1961



Others in first 4 species but not in first 2

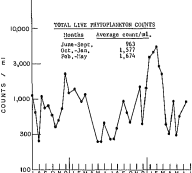
Coscinodiscus rothii
Melosira italica
Melosira varians
Nitzschia palea type
Synedra acus



ZOOPLANKTON

Samples analyzed 20
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	6	0.8
Keratella	4	0.4
Polyarthra	1	0.1
Brachionus	2	0.3
Synchaeta	0	0
Other genera	2	0
Crustaceans.		
nauplii	2	0.2
copepods	3	0.3
cladocerans	0	0
Nematodes		6.
Other invertebrate metazoans		0



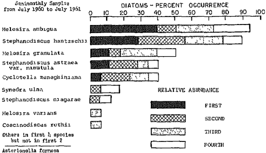
TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	963
Oct.-Jan.	1,577
Feb.-May	1,674

MOST ABUNDANT GENERA OF ALGAE

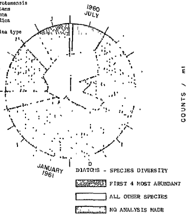
Percent frequency of counts 150 per ml. or more From May 1959 to May 1961	
Green flagellates	
Chlamydomonas	3
Diatoms	
Centric	
Cyclotella	7
Melosira	44
Stephanodiscus	67
Pennate	
Fragilaria	3
Synedra	15

MISSISSIPPI RIVER
WEST MEMPHIS, ARKANSAS



Others in first 4 species but not in first 2

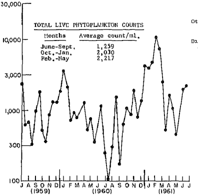
Asterionella formosa
Fragilaria crotonensis
Melosira distans var. alpigena
Melosira italica
Navicula sp.
Nitzschia palea type
Synedra acu



Z O O P L A N K T O N

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	8	3.7
Keratella	5	1.4
Polyarthra	6	0.5
Brachionus	5	1.5
Synchaeta	1	0
Crustaceans:		
nauplii	2	0.1
copepods	2	0.1
cladocerans	2	0.1
Nematodes		2.0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

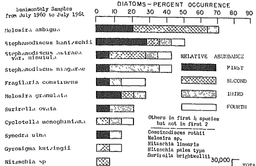
Months	Average count/ml.
June-Sept.	1,259
Oct.-Jan.	2,030
Feb.-May	2,217

M O S T A B U N D A N T G E N E R A O F A L G A E

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961

Green algae	
Scenedesmus	6
Green flagellates	
Chalmydomonas	2
Phacus	2
Trachelomonas	2
Other pigmented flagellates	
Chromulina	2
Diatoms	
Centric	
Cyclotella	10
Melosira	54
Stephanodiscus	77
Pennate	
Asterionella	2
Synedra	27

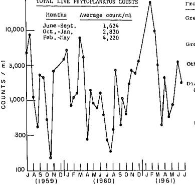
MISSISSIPPI RIVER
CAPE GIRARDEAU, MISSOURI



ZOOPLANKTON

Samples analyzed 19
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	7	2.8
Keratella	4	1.0
Polyarthra	4	0
Brachionus	6	1.2
Synchaeta	2	0
Other genera	3	0.8
Crustaceans:		
nauplii	1	0
copepods	3	0
cladocerana	0	0
Nematodes		1
Other invertebrate metazoans		0



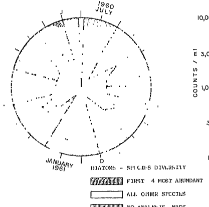
TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml
June-Sept.	1,624
Oct.-Jan.	2,830
Feb.-May	4,220

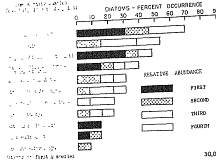
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml or more
From May 1959 to May 1961

Green algae	
Scenedesmus	7
Tetradesmus	2
Green flagellates	
Chlamydomonas	5
Other pigmented flagellates	
Chromulina	2
Diatoms	
Centric	
Cyclotella	20
Melosira	39
Stephanodiscus	73
Pennate	
Asterionella	5
Diatoma	2
Gyrosigma	2
Navicula	2
Nitzschia	5
Surirella	7
Synedra	20



MISSOURI RIVER
ST LOUIS, MISSOURI



Diatoms [illegible] first 4 species
[illegible] in first 2

[illegible]
Melosira ambigua
Navicula sp.
Stephanodiscus niagarae
Surirella [illegible]

ZOOPLANKTON

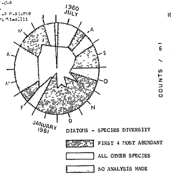
Samples analyzed 23
July 1960 to July 1961

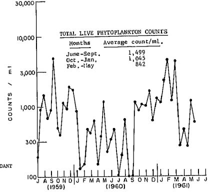
	Samples with Animals	Average count per liter per sample
Rotifers.	3	0
Keratella	1	0
Polyarthra	0	0
Brachionus	0	0
Synchaeta	0	0
Other genera	1	0
Crustaceans:		
nauplii	1	0
copepods	3	0
cladocerans	0	0
Nematodes		2
Other invertebrate metazoans		0

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
from May 1959 to May 1961

Green algae	
Ankistrodesmus	2
Scenedesmus	4
Green flagellates	
Chlamydomonas	4
Trachelomonas	2
Diatoms	
Centric	
Cyclotella	6
Melosira	6
Stephanodiscus	53
Pennate	
Asterionella	4
Fragilaria	2
Gomphonema	2
Navicula	2
Synedra	23

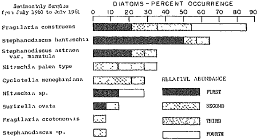




TOTAL LIVE PHYTOPLANKTON COUNTS

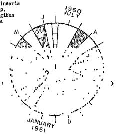
Months	Average count/ml.
June-Sept.	1,499
Oct.-Jan.	1,045
Feb.-May	842

MISSOURI RIVER
KANSAS CITY, KANSAS



Others in first 4 species but not in first 2

Amphiprora paludosa
Fragilaria capucina
Nitzschia acicularis
Nitzschia linearis
Nitzschia sp.
Rhopalodia gibba
Synedra ulna



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

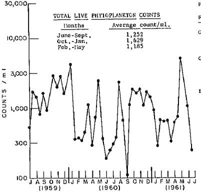
☐ ALL OTHER SPECIES

☐ NO ANALYSIS MADE

ZOOPLANKTON

Samples analyzed 18
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	0	0
Keratella	0	0
Polyarthra	0	0
Brachionus	0	0
Synchaeta	0	0
Others	0	0
Crustacea:		
nauplii	0	0
Copepods	0	0
Cladocera	0	0
Nematodes	0	2
Other invertebrate metazoan		0



TOTAL LIVE PHYTOPLANKTON COUNTS

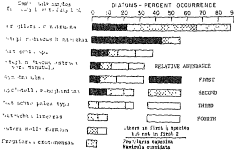
Months	Average count/ml.
June-Sept.	1,252
Oct.-Jan.	1,629
Feb.-May	1,185

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Green algae	
Ankistrodesmus	2
Scenedesmus	13
Green Flagellates	
Chlamydomonas	17
Phacotus	3
Trachelomonas	2
Diatoms	
Centric	
Cyclotella	13
Melosira	9
Stephanodiscus	57
Pennate	
Asterionella	6
Fragilaria	11
Gomphonema	2
Navicula	6
Nitzschia	11
Surirella	4
Synedra	21

MISSOURI RIVER
ST JOSEPH, MISSOURI



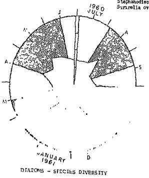
Others in first 4 species but not in first 2

Fragilaria capucina
Navicula cuspidata
Navicula sp.
Rhopalodia gibba
Stephanodiscus sp.
Surirella ovata

ZOOPLANKTON

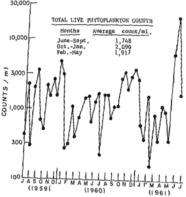
Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	1	0.1
Keratella	0	0
Polyarthra	0	0
Brachionus	1	0
Synchaeta	0	0
Other genera	0	0
Crustaceans.		
nauplii	0	0
copepods	2	0.6
cladocerans	0	0
Nematodes		3
Other invertebrate metazoans		0



DIATOMS - SPECIES DIVERSITY

▩ FIRST 4 MOST ABUNDANT



TOTAL LIVE PHYTOPLANKTON COUNTS

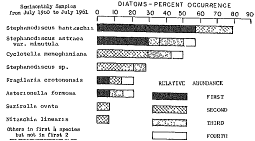
Months	Average count/ml.
June-Sept.	1,748
Oct.-Jan.	2,090
Feb.-May	1,917

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961

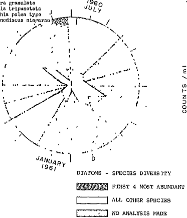
Blue-green algae	
Anacystis	2
Green algae	
Actinastrum	2
Ankistrodesmus	6
Scenedesmus	14
Green flagellates	
Chlamydomonas	16
Euglena	2
Trachelomonas	10
Diatoms	
Centric	
Cyclotella	18
Melosira	16
Stephanodiscus	71
Pennate	
Asterionella	14
Fragilaria	16
Navicula	4
Nitzschia	16
Synedra	22

MISSOURI RIVER
OMAHA, NEBRASKA



Others in first 4 species but not in first 2

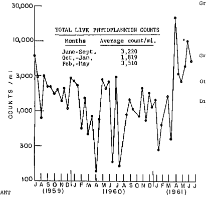
- Cymbella tumida
- Diatoma vulgare
- Melosira ambigua
- Melosira granulata
- Navicula tripunctata
- Nitzschia palea typo
- Stephanodiscus niagarae



ZOOPLANKTON

Samples analyzed 20
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers·	3	0.5
Keratella	1	0.1
Polyarthra	1	0.1
Brachionus	2	0.3
Synchaeta	0	0
Other genera	0	0
Crustaceans.		
nauplii	2	0.3
copepods	5	0.5
cladocerans	1	0.1
Nematodes		3
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

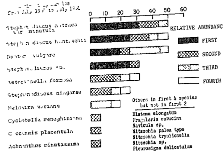
Months	Average count/ml.
June-Sept.	3,220
Oct.-Jan.	1,819
Feb.-May	3,510

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Green algae	
Ankistrodesmus	7
chlorella-type	2
Oocystis	2
Scenedesmus	11
Selenastrum	2
Stichococcus	2
Green flagellates	
Chlamydomonas	24
Trachelomonas	7
Other pigmented flagellates	
Chrysococcus	2
Diatoms	
Centric	
Cyclotella	7
Melosira	17
Stephanodiscus	85
Pennate	
Asterionella	22
Diatoma	3
Navicula	2
Nitzschia	17
Surirella	7
Synedra	22

MISSOURI RIVER
YANKTON, SOUTH DAKOTA



ZOOPLANKTON

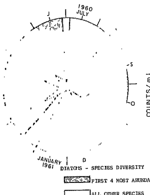
Samples analyzed 74
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	16	27.3
Keratella	8	20.9
Polyarthra	6	1.5
Brachionus	4	0.6
Synchaeta	6	2.0
Other genera	11	2.3
Crustaceans.		
nauplii	10	3.9
copepods	10	6.5
cladocerans	3	2.0
Nematodes		0
Other invertebrate metazoans		0

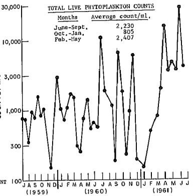
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	2
Green algae	
Ankistrodesmus	7
chlorella-type	4
Scenedesmus	4
Selenastrum	1
Green flagellates	
Chlamydomonas	11
Euglena	2
Trachelomonas	13
Other pigmented flagellates	
Gymnodinium	2
Diatoms	
Centric	
Cyclotella	4
Melosira	2
Stephanodiscus	72
Pennate	
Asterionella	26
Cocconeis	2
Cymbella	4
Diatoma	11
Gomphonema	2
Navicula	4
Nitzschia	9
Pleurosigma	2
Synedra	9



DIATOMS - SPECIES DIVERSITY

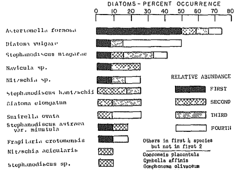


TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	2,230
Oct.-Jan.	805
Feb.-May	2,407

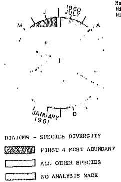
MISSOURI RIVER
BISMARCK, NORTH DAKOTA

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Cocconeis placentula
Cymbella affinis
Gomphonema olivaceum
Melosira ambigua
Nitzschia palea type
Nitzschia sp.

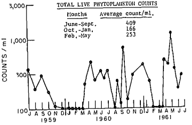


DIATOMS - SPECIES DIVERSITY

ZOOPLANKTON

Samples analyzed 19
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	8	4.8
Keratella	3	0.5
Polyarthra	5	3.2
Brachionus	1	0.1
Synchaeta	0	0
Crustaceans.		
nauplii	9	5.6
copepods	6	2.1
cladocerans	1	1.1
Nematodes		2.0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

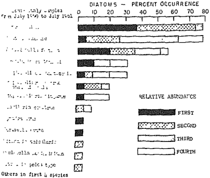
Months	Average count/ml.
June-Sept.	409
Oct.-Jan.	166
Feb.-May	253

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

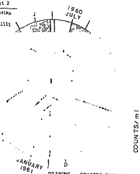
Diatoms	
Centric	
Stephanodiscus	9
Pennate	
Asterionella	3
Synedra	6

MISSOURI RIVER
WILLISTON, NORTH DAKOTA



Others in first 4 species but not in first 2

Achnanthes minutissima
Navicula viridula
Surirella brightwellii



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

ZOOPLANKTON

Samples analyzed 24
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	8	0.9
Keratella	1	0
Polyarthra	1	0
Brachionus	1	0
Synchaeta	1	0
Other genera	3	0
Crustaceans.		
nauplii	1	0
copepods	3	0.5
cladocerans	0	0
Nematodes		1

Other metazoan invertebrates none

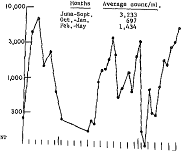
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
From May 1959 to May 1961

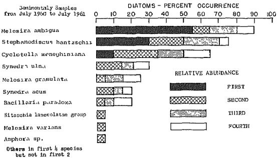
Blue-green algae	
Anacystis	6
Aphanizomenon	3
Green algae	
Actinastrum	3
Ankistrodesmus	3
Oocystis	3
Scenedesmus	6
Green flagellates	
Chlamydomonas	6
Trachelomonas	6
Diatoms	
Centric	
Cyclotella	8
Stephanodiscus	47
Pennate	
Asterionella	36
Cymbella	6
Diatoma	22
Fragilaria	17
Navicula	29
Nitzschia	25
Surirella	3
Synedra	44

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	3,233
Oct.-Jan.	697
Feb.-May	1,434

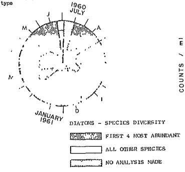


OHIO RIVER
CAIRO, ILLINOIS



Others in first 4 species but not in first 2

Cyclotella atomus
Cymbella affinis
Fragilaria crotonensis
Melosira distans var, alpigena
Nitzschia palea type
Surirella ovata

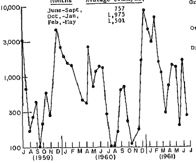


ZOOPLANKTON

Samples analyzed 24
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	9	3.0
Keratella	6	2.0
Polyarthra	1	0
Brachionus	5	1.0
Synchaeta	1	0
Other genera	3	0
Crustaceans:		
nauplii	0	0
copepods	1	0.1
cladocerans	8	0.6
Nematodes		2.0
Other invertebrate metazoans		0

TOTAL LIVE PHYTOPLANKTON COUNTS



Months	Average count/ml.
June-Sept.	757
Oct.-Jan.	1,975
Feb.-May	1,501

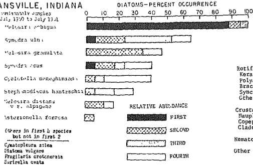
MOST ABUNDANT GENERA OF ALGAE

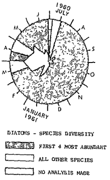
Percent frequency of counts 150 per ml.or more From May 1959 to May 1961

Blue-green algae	
Anacystis	6
Green algae	
Ankistrodesmus	4
chlorella-type	2
Scenedesmus	4
Stichococcus	2
Green flagellates	
Chlamydomonas	2
Trachelomonas	2
Other pigmented flagellates	
Chromulina	2
Diatoms	
Centric	
Cyclotella	38
Melosira	40
Stephanodiscus	22
Pennate	
Gomphonema	4
Nitzschia	2
Synedra	32

OHIO RIVER
EVANSVILLE, INDIANA

Semimonthly samples
from July 1960 to July 1961





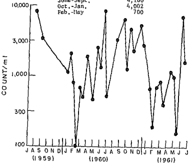
ZOOPLANKTON

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	14	71
Keratella	12	59
Polyarthra	11	4
Brachionus	6	2
Synchaeta	2	0
Others	10	6
Crustacea:		
Nauplii	5	1.7
Copepods	7	1.7
Cladocera	6	1.4
Nematodes		5
Other invertebrate metazoans		0

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml
June-Sept.	4,180
Oct.-Jan.	4,002
Feb.-May	700



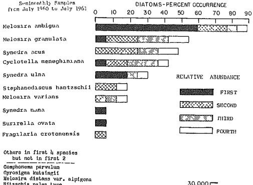
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anabaena	3
Anacystis	15
Aphanizomenon	4
Oscillatoria	6
Green algae	
Actinastrum	3
Ankistrodesmus	4
Dictyosphaerium	3
Golenkinia	3
Micractinium	3
Oocystis	3
Radiococcus	3
Scenedesmus	15
Spirogyra	3
Tetradesmus	3
Tetrastrum	3
Ulothrix	4
Westella	3
Green flagellates	
Chlamydomonas	9
Trachelomonas	3
Other pigmented flagellates	
Chromulina	9
Diatoms	
Centric	
Cyclotella	3
Melosira	70
Stephanodiscus	36
Pennate	
Asterionella	9
Gomphonema	3
Navicula	3
Surirella	3
Synedra	48

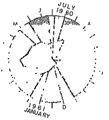
OHIO RIVER
CINCINNATI, OHIO

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Gomphonema parvulum
Gyrosigma kutzingii
Melosira distans var. alpigena
Nitzschia palea type
Pinnularia sp.



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

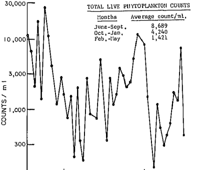
☐ ALL OTHER SPECIES

▨ NO ANALYSIS MADE

ZOOPLANKTON

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	12	58.0
Keratella	10	39.7
Polyarthra	10	5.6
Brachionus	9	6.6
Synchaeta	4	3.5
Other genera	8	11.1
Crustaceans		
nauplii	6	1.3
copepods	6	2.0
cladocerans	7	2.0
Nematodes		2.0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

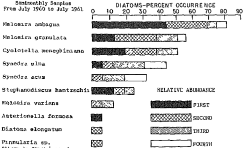
Months	Average count/ml.
June-Sept.	8,689
Oct.-Jan.	4,240
Feb.-May	1,421

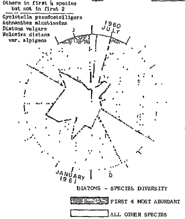
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anabaena	9
Anacystis	27
Aphanizomenon	9
Arthrospira	2
Oscillatoria	18
Phormidium	4
Raphidiopsis	2
Green algae	
Actinastrum	4
Ankistrodesmus	13
Chlorella-type	20
Chlorococcum	7
Dictyosphaerium	16
Dimorphococcus	2
Golenkinia	7
Oocystis	4
Palmellococcus	2
Scenedesmus	27
Green flagellates	
Chlamydomonas	20
Trachelomonas	11
Other pigmented flagellates	
Chromulina	11
Diatoms	
Centric	
Cyclotella	42
Melosira	69
Stephanodiscus	18
Pennate	
Asterionella	7
Cymbella	4
Diatoma	2
Gomphonema	7
Navicula	16
Nitzschia	11
Synedra	69

OHIO RIVER
HUNTINGTON, WEST VIRGINIA

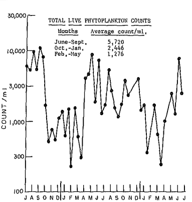




ZOOPLANKTON

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	13	28
Keratella	12	20
Polyarthra	10	6
Brachionus	9	2
Synchaeta	7	1
Other genera	8	0
Crusraceans:		
nauplii	6	1.1
copepods	5	2.0
cladocerans	6	1.3
Nematodes		0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

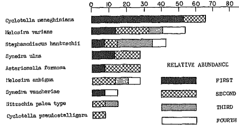
Months	Average count/ml.
June-Sept.	5,720
Oct.-Jan.	2,446
Feb.-May	1,276

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961	
Blue-green algae	
Anabaena	7
Anacystis	24
Gomphosphaeria	4
Oscillatoria	7
Rhaphidiopsis	2
Green algae	
Actinastrum	4
Ankistrodesmus	24
chlorella-type	9
Coelastrum	2
Dictyosphaerium	4
Golenkinia	9
Kirchneriella	2
Lagerheimia	2
Micractinium	2
Oocystis	4
Scenedesmus	36
Selenastium	2
Staurastrum	2
Tetradesmus	7
Green flagellates	
Chlamydomonas	20
Phacotus	2
Trachelomonas	4
Other pigmented flagellates	
Chromulina	7
Chrysococcus	2
Diatoms	
Centric	
Cyclotella	47
Melosira	64
Stephanodiscus	20
Pennate	
Asterionella	9
Diatoma	4
Fragilaria	2
Gomphonema	2
Navicula	11
Nitzschia	11
Surirella	2
Synedra	60

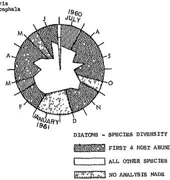
OHIO RIVER
EAST LIVERPOOL, OHIO

Semimonthly Samples from July 1960 to July 1961



Others in first 4 species but not in first 2

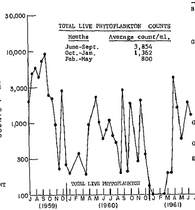
Achnanthes minutissima
Cocconeis placentula
Diatoma elongatum
Diatoma vulgare
Fragilaria capucina
Frustulia vulgaris
Navicula cryptocephala
Navicula sp.
Nitzschia sp.
Nitzschia sp.



ZOOPLANKTON

Samples analyzed 20
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	10	13.0
Keratella	5	1.0
Polyarthra	4	1.0
Brachionus	7	3.4
Synchaeta	2	3.0
Other genera	7	4.6
Crustaceans.		
nauplii	6	1.7
copepods	4	4.0
cladocerans	1	1.0
Nematodes		1.0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

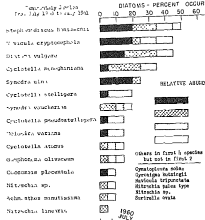
Months	Average count/ml.
June-Sept.	3,854
Oct.-Jan.	1,362
Feb.-May	800

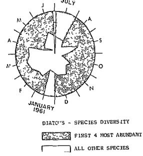
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961

Blue-green algae	
Anacystis	13
Calothirx	2
Gomphosphaeria	9
Oscillatoria	2
Green algae	
Actinastrum	7
Ankistrodesmus	20
chlorella-type	11
Closterium	4
Coelastrum	2
Dictyosphaerium	2
Golenkinia	4
Micractinium	2
Palmellococcus	2
Scenedesmus	24
Tetradesmus	11
Tetraspora	2
Green flagellates	
Chlamydomonas	28
Trachelomonas	4
Other pigmented flagellates	
Chromulina	9
Diatoms	
Centric	
Cyclotella	24
Melosira	9
Stephanodiscus	9
Pennate	
Asterionella	4
Diatoma	2
Gomphonema	4
Navicula	13
Nitzschia	7
Synedra	37

POTOMAC RIVER
GREAT FALLS, MARYLAND

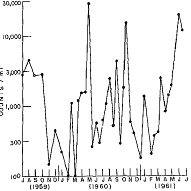




ZOOPLANKTON

Samples analyzed 24
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	7	2.9
Keratella	4	0.2
Polyarthra	2	0.2
Brachionus	2	0.1
Synchaeta	0	0
Other genera	6	2.4
Crustaceans:		
nauplii	0	0
copepods	1	0.1
cladocerans	0	0
Nematodes		3
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	2,612

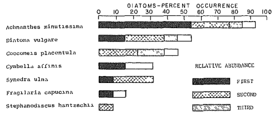
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml or more
From May 1959 to May 1961

Blue-green algae	
Agmenellum	6
Anacystis	14
Green algae	
Actinastrum	3
Ankistrodesmus	6
chlorella-type	6
Closterium	3
Coelastrum	3
Crucigenia	3
Dictyosphaerium	3
Oocystis	6
Pediastrum	6
Scenedesmus	28
Staurastrum	3
Green flagellates	
Chlamydomonas	11
Other pigmented flatellates	
Chromulina	6
Diatoms	
Centric	
Cyclotella	28
Melosira	6
Stephanodiscus	28
Pennate	
Cymbella	3
Diatoma	6
Gomphonema	3
Navicula	17
Nitzschia	11
Surirella	3
Synedra	31

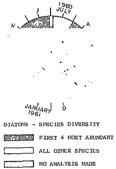
POTOMAC RIVER
WILLIAMSPORT, MD.

Semimonthly samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Cymbella ventricosa
Gomphonema parvulum
Navicula cryptocephala
Navicula hungarica
Navicula sp.
Nitzschia palea typo
Synedra vaucheriae



ZOOPLANKTON

Samples analyzed 20
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers,	8	1,4
Keratella	0	0
Polyarthra	0	0
Brachionus	0	0
Synchaeta	0	0
Other genera	4	1,1
Crustaceans		
nauplii	1	0,1
copepods	0	0
cladocerans	1	0,1
Nematodes		0
Other invertebrate metazoans		0

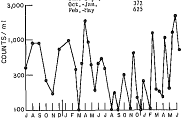
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

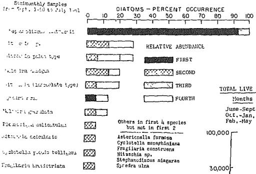
Blue-green algae	
Anacystis	3
Green flagellates	
Chlamydomonas	6
Diatoms	
Centric	
Cyclotella	11
Stephanodiscus	6
Pennate	
Achnanthes	3
Cymbella	14
Navicula	9
Synedra	23

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	558
Oct.-Jan.	372
Feb.-May	625

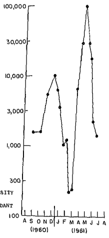


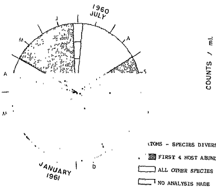
RED RIVER (NORTH)
GRAND FORKS, NORTH DAKOTA



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	1,798
Oct.-Jan.	13,221
Feb.-May	24,015





ZOOPLANKTON

Samples analyzed 18
Nov, 1960 to Aug, 1961

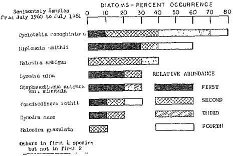
	Samples with Animals	Average count per liter per sample
Rotifers.	13	175.9
Keratella	9	63.0
Polyarthra	8	42.6
Brachionus	5	47.7
Synchaeta	9	3.0
Other genera	9	19.6
Crustaceans.		
nauplii	6	49.1
copepods	5	6.0
cladocerans	2	0
Nematodes		2.0
Other invertebrate metazoans		0

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From Sept. 1960 to July 1961

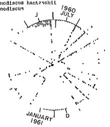
Blue-green algae	
Oscillatoria	5
Raphidiopsis	5
Green algae	
Ankistrodesmus	11
Dictyosphaerium	5
Scenedesmus	29
Green flagellates	
Chlamydomonas	31
Phacotus	4
Trachelomonas	28
Other pigmented flagellates	
Chromulina	6
Peridinium	4
Diatoms	
Centric	
Cyclotella	11
Melosira	17
Stephanodiscus	94
Pennate	
Asterionella	5
Cymatopleura	5
Cymbella	7
Gomphonema	6
Nitzschia	17
Pleurosigma	5
Synedra	36

RED RIVER (SOUTH)
ALEXANDRIA, LOUISIANA



Others in first 4 species but not in first 2

- Amphiprora sp.
- Eunotia sp
- Nitzschia acicularis
- Opephora sp.
- Stephanodiscus hantzschii
- Stephanodiscus



DIATOMS – SPECIES DIVERSITY

▩ FIRST 4 MOST ABUNDANT

☐ ALL OTHER SPECIES

▭ NO ANALYSIS MADE

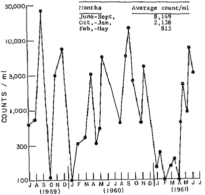
ZOOPLANKTON

Samples analyzed 17
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	13	48.8
Keratella	3	43.0
Polyarthra	3	1.5
Brachionus	1	0
Synchaeta	0	0
Others	9	6.3
Crustacea.		
Nauplii	0	0
Copepods	1	0
Cladocera	0	0
Nematodes		1
Other invertebrate metazoans		0

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml
June-Sept.	8,149
Oct.-Jan.	2,138
Feb.-May	815



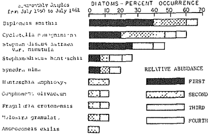
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961

Blue-green algae	
Agmenellum	16
Anabaena	13
Anacystis	19
Arthrospira	3
Oscillatoria	13
Phormidium	6
Spirulina	3
Green algae	
Ankistrodesmus	16
Chlorococcum	3
Crucigenia	3
Oocystis	19
Scenedesmus	10
Staurastrum	3
Tetradesmus	3
Green flagellates	
Chlamydomonas	13
Trachelomonas	3
Diatoms	
Centric	
Coscinodiscus	3
Cyclotella	35
Melosira	13
Stephanodiscus	16
Pennate	
Cocconeis	6
Diploneis	16
Navicula	6
Nitzschia	16
Synedra	29

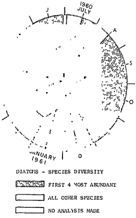
RED RIVER (SOUTH)
INDEX, TEXAS

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

- Biddulphia laevis
- Cyclotella sp.
- Melosira ambigua
- Navicula sp.
- Nitzschia acicularis
- Nitzschia dissipata
- Stephanodiscus sp.
- Surirella angustata



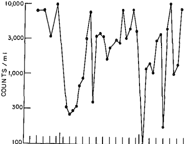
ZOOPLANKTON

Samples analyzed 23
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	11	8.0
Keratella	8	3.5
Polyarthra	5	0
Brachionus	6	1.7
Synchaeta	4	1.6
Other genera	6	1.2
Crustaceans		
nauplii	0	0
copepods	1	0
cladocerans	0	0
Nematodes		3
Other invertebrate metazoan		0

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	3,635
Oct.-Jan.	4,395
Feb.-May	2,034

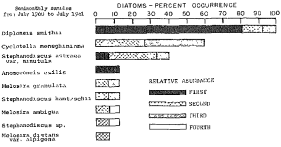


MOST ABUNDANT GENERA OF ALGAE

Per cent frequency of counts
150 per ml. or more
from Sept. 1959 to May 1961

Blue-green algae	
Agmenellum	20
Anabaena	5
Anacystis	20
Aphanizomenon	8
Gomphosphaeria	2
Oscillatoria	2
Raphidiopsis	2
Green algae	
Actinastrum	5
Ankistrodesmus	11
Chlorococcum	5
Closterium	2
Coelastrum	8
Crucigenia	11
Dictyosphaerium	2
Lagerheimia	2
Oocystis	45
Scenedesmus	37
Tetradesmus	8
Tetrastrum	2
Green flagellates	
Chlamydomonas	31
Euglena	5
Trachelomonas	11
Other pigmented flagellates	
Chromulina	5
Diatoms	
Centric	
Cyclotella	34
Melosira	5
Rhizosolenia	2
Stephanodiscus	20

RED RIVER (SOUTH)
DENISON, TEXAS



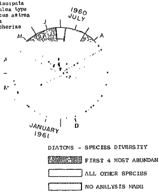
ZOOPLANKTON

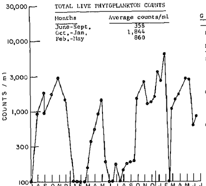
Samples analyzed 22
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	12	6
Keratella	8	1
Polyarthra	1	0
Brachionus	3	0
Synchaeta	3	2
Others	7	3
Crustacea		
Nauplii	9	1
Copepods	8	2
Cladocera	11	2
Other invertebrate metazoans		0

Others in first 4 species but not in first 2

- Chaetoceros sp.
- Coscinodiscus rothii
- Nitzschia dissipata
- Nitzschia palea type
- Stephanodiscus astrea
- Synedra ulna
- Synedra vaucheriae





TOTAL LIVE PHYTOPLANKTON COUNTS

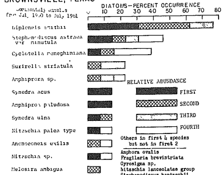
Months	Average counts/ml
June-Sept.	358
Oct.-Jan.	1,844
Feb.-May	860

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1957 to May 1961

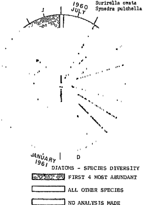
Blue-green algae	
Anabaena	3
Anacystis	8
Oscillatoria	3
Green algae	
Crucigenia	11
Oocystis	37
Tetrastrum	3
Green flagellates	
Chlamydomonas	18
Phacotus	3
Trachelomonas	3
Diatoms	
Centric	
Coscinodiscus	3
Cyclotella	16
Melosira	3
Stephanodiscus	5
Pennate	
Cocconeis	5
Diploneis	29
Synedra	5

RIO GRANDE
BROWNSVILLE, TEXAS



Others in first 4 species but not in first 2

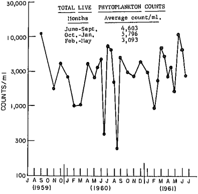
- Amphora ovalis
- Fragilaria brevistriata
- Gyrosigma sp.
- Nitzschia lanceolatae group
- Stephanodiscus hantzschii
- Surirella ovata
- Synedra pulchella



ZOOPLANKTON

Samples analyzed 18
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	11	137.2
Keratella	7	4.5
Polyarthra	5	0.9
Brachionus	3	1.3
Synchaeta	5	11.1
Other genera	7	119.4
Crustaceans:		
nauplii	2	0.3
copepoda	5	0.4
cladocerans	0	0
Nematodes		1
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	4,603
Oct.-Jan.	5,796
Feb.-May	3,093

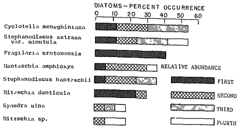
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From Sept. 1959 to May 1961

Blue-green algae	
Agmenellum	28
Anacystis	24
Green algae	
Ankistrodesmus	32
Chlorococcum	4
Cosmarium	4
Crucigenia	4
Nannochloris	4
Oocystis	20
Scenedesmus	52
Sphaerocystis	4
Tetradesmus	8
Green flagellates	
Chlamydomonas	12
Trachelomonas	8
Diatoms	
Centric	
Cyclotella	28
Stephanodiscus	20
Pennate	
Amphipleura	4
Amphiprora	10
Amphora	4
Anomoeneis	4
Cocconeis	12
Diploneis	32
Fragilaria	12
Navicula	36
Nitzschia	44
Pleurosigma	4
Surirella	12
Synedra	68

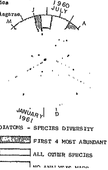
RIO GRANDE,
LAREDO, TEXAS

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Navicula cuspidata
Navicula sp.
Nitzschia lanceolatae group
Nitzschia hungarica
Nitzschia sigma
Stephanodiscus niagarae



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

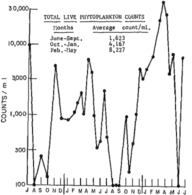
☐ ALL OTHER SPECIES

☐ NO ANALYSIS MADE

ZOOPLANKTON

Samples analyzed 18
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	1	0.1
Keratella	1	0.1
Polyarthra	0	0
Brachionus	0	0
Synchaeta	0	0
Other genera	0	0
Crustaceans:		
nauplii	0	0
copepods	0	0
cladocerans	0	0
Nematodes		5
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

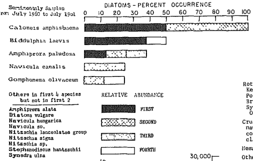
Months	Average count/ml.
June-Sept.	1,623
Oct.-Jan.	4,167
Feb.-May	8,227

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

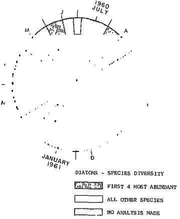
Blue-green algae	
Agmenellum	3
Anacystis	3
Oscillatoria	3
Green algae	
Ankistrodesmus	11
chlorella-type	3
Closterium	6
Dictyosphaerium	3
Gloeocystis	3
Oocystis	3
Scenedesmus	17
Green flagellates	
Chlamydomonas	6
Other pigmented flagellates	
Dinobryon	3
Diatoms	
Centric	
Cyclotella	36
Stephanodiscus	33
Pennate	
Cocconeis	6
Cymbella	3
Fragilaria	17
Navicula	22
Nitzschia	22
Pleuorsigma	3
Synedra	39

RIO GRANDE
EL PASO, TEXAS



Others in first 4 species but not in first 2

Amphiprora alata
Diatoma vulgare
Navicula hungarica
Navicula sp.
Nitzschia lanceolatae group
Nitzschia sigma
Nitzschia sp.
Stephanodiscus hantzschii
Synedra ulna



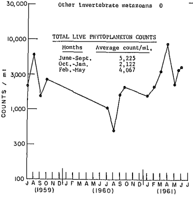
DIATOMS - SPECIES DIVERSITY

- ▨ FIRST 4 MOST ABUNDANT
- ☐ ALL OTHER SPECIES
- ☐ NO ANALYSIS MADE

ZOOPLANKTON

Samples analyzed 10
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	2	2.1
Keratella	1	0.7
Polyarthra	0	0
Brachionus	0	0
Synchaeta	0	0
Other genera	2	1.4
Crustaceans.		
nauplii	0	0
copepods	1	0.2
cladocerans	1	0.2
Nematodes		2.0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

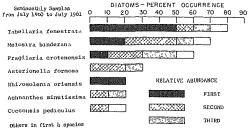
Months	Average count/ml.
June-Sept.	5,225
Oct.-Jan.	2,122
Feb.-May	4,067

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more From May 1959 to May 1961

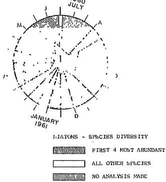
Blue-green algae	
Anacystis	13
Green algae	
chlorella-type	7
Chlorococcum	7
Lagerheimia	7
Scenedesmus	13
Green flagellates	
Chlamydomonas	20
Euglena	26
Trachelomonas	7
Diatoms	
Centric	
Biddulphia	13
Cyclotella	66
Melosira	13
Stephanodiscus	33
Pennate	
Amphiprora	26
Asterionella	7
Caloneis	33
Cocconeis	13
Gomphonema	7
Navicula	33
Nitzschia	47

ST LAWRENCE RIVER
MASSENA, NEW YORK



Others in first 4 species but not in first 2

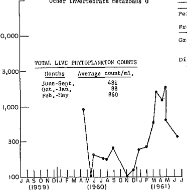
Cocconeis placentula
Cymbella ventricosa
Diatoma elongatum
Fragilaria capucina
Melosira islandica
Stephanodiscus astraea var. minutula
Stephanodiscus hantzschii



ZOOPLANKTON

Samples analyzed 16
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	16	16.0
Keratella	15	7.3
Polyarthra	5	0.8
Brachionus	6	1.1
Synchaeta	6	0.6
Other genera	15	10.8
Crustaceans:		
nauplii	3	0.7
copepods	4	0.3
cladocerans	3	0.3
Nematodes		1.
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

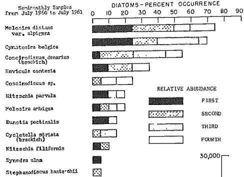
Months	Average count/ml.
June-Sept.	481
Oct.-Jan.	88
Feb.-May	860

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
From April 1960 to August 1961

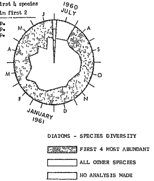
Green algae	
Ankistrodesmus	10
Diatoms	
Centric	
Melosira	21
Stephanodiscus	31
Pennate	
Asterionella	10
Fragilaria	5
Tabellaria	15

SAVANNAH RIVER
PORT WENTWORTH, GEORGIA



Others in first 4 species but not in first 2

Gyrosigma sp.
Nitzschia sp.
Nitzschia sp.



DIATOMS - SPECIES DIVERSITY

▨ FIRST 4 MOST ABUNDANT

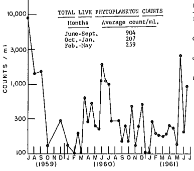
☐ ALL OTHER SPECIES

☐ NO ANALYSIS MADE

ZOOPLANKTON

Samples analyzed 22
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	9	1.0
Keratella	3	0
Polyarthra	4	0
Brachionus	1	0
Synchaeta	0	0
Other genera	3	0
Crustaceans		
nauplii	0	0
copepods	4	0.2
cladocerans	1	0.1
Nematodes		1.0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	904
Oct.-Jan.	207
Feb.-May	259

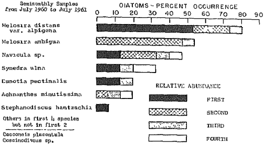
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	2
Green algae	
Ankistrodesmus	2
Green flagellates	
Chlamydomonas	[illegible]
Diatoms	
Centric	
Cyclotella	7
Melosira	17
Stephanodiscus	2
Pennate	
Synedra	9

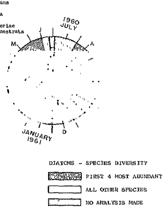
SAVANNAH RIVER
NORTH AUGUSTA, SOUTH CAROLINA

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

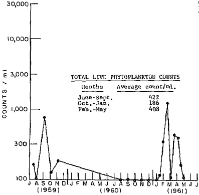
Cocconeis placentula
Coscinodiscus sp.
Cymatosira beligica
Cyclotella meneghiniana
Cyclotella stelligera
Melosira granulata
Melosira varians
Melosira sp.
Navicula notha
Navicula sp.
Synedra vaucheriae
Tabellaria fenestrata



ZOOPLANKTON

Samples analyzed 15
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	6	2.0
Keratella	4	1.0
Polyarthra	4	1.0
Brachionus	0	0
Synchaeta	0	0
Crustaceans:		
nauplii	3	0.4
copepods	2	0.2
cladocerans	0	0
Nematodes		0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

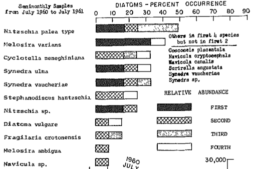
Months	Average count/ml.
June-Sept.	422
Oct.-Jan.	186
Feb.-May	408

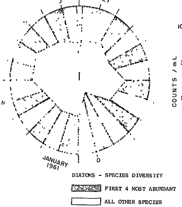
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	4
Diatoms	
Centric	
Cyclotella	9
Pennate	
Synedra	9

SCHUYLKILL RIVER
PHILADELPHIA, PENNSYLVANIA

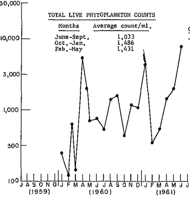




ZOOPLANKTON

Samples analyzed 13
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	9	13.0
Keratella	2	0.5
Polyarthra	0	0
Brachionus	1	0.2
Synchaeta	1	0.1
Other genera	6	12.2
Crustaceans:		
nauplii	2	2.0
copepods	2	1.0
cladocerans	4	2.1
Nematodes		8.0
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	1,033
Oct.-Jan.	1,486
Feb.-May	1,431

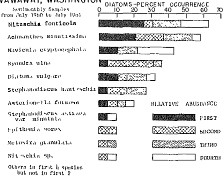
MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
From January 1960 to May 1961

Green algae	
Scenedesmus	11
Diatoms	
Centric	
Cyclotella	16
Melosira	5
Stephanodiscus	22
Pennate	
Achnanthes	5
Diatoma	11
Gomphonema	5
Navicula	22
Nitzschia	33
Surirella	11
Synedra	33

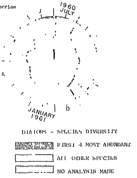
SNAKE RIVER
WAWAWAI, WASHINGTON

Semimonthly Samples
from July 1960 to July 1961



Others in first 4 species
but not in first 2

Gomphonema herculeanum
Navicula sp.
Nitzschia sigmoidea
Rhoicosphenia curvata
Synedra acus
Synedra vaucheriae



DIATOMS - SPECIES DIVERSITY

ZOOPLANKTON

Samples analyzed 21
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers	14	4.7
Keratella	10	2.0
Polyarthra	2	0.5
Brachionus	4	0
Synchaeta	4	0
Other genera	7	2.2
Crustaceans:		
nauplii	1	0
copepods	0	0
cladocerans	0	0
Nematodes		1
Other invertebrate metazoans		0

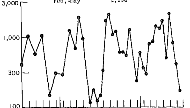
MOST ABUNDANT GENERA OF ALGAL

Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

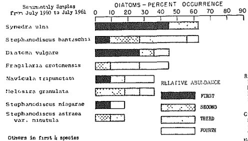
Green flagellates	
Chlamydomonas	3
Diatoms	
Centric	
Cyclotella	16
Melosira	8
Stephanodiscus	22
Pennate	
Achnanthes	11
Asterionella	8
Cymbella	1
Diatoma	8
Gomphonema	3
Navicula	24
Nitzschia	19
Synedra	30

TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	1,067
Oct.-Jan.	536
Feb.-May	1,296

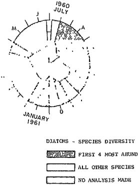


SNAKE RIVER
WEISER, IDAHO



Others in first 4 species but not in first 2

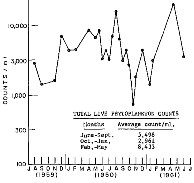
Asterionella formosa
Melosira ambigua
Navicula viridula
Nitzschia dissipata



ZOOPLANKTON

Samples analyzed 13
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	12	18.8
Keratella	9	10.9
Polyarthra	5	1.8
Brachionus	8	1.0
Synchaeta	4	1.8
Other genera	10	16.6
Crustaceans		
nauplii	2	0.5
copepods	2	0
cladocerans	2	0
Nematodes		1
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	5,498
Oct.-Jan.	2,961
Feb.-May	8,433

MOST ABUNDANT GENERA OF ALGAE

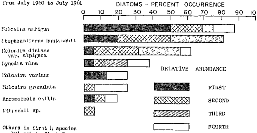
Percent frequency of counts
150 per ml or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	4
Oscillatoria	4
Green algae	
Micractinium	4
Scenedesmus	7
Green flagellates	
Chlamydomonas	22
Euglena	4
Other pigmented flagellates	
Chromulina	7
Diatoms	
Centric	
Biddulphia	4
Cyclotella	52
Melosira	30
Stephanodiscus	63
Pennate	
Achnanthes	11
Asterionella	7
Cocconeis	14
Cymatopleura	4
Cymbella	7
Diatoma	30
Fragilaria	37
Gomphonema	4
Navicula	63
Nitzschia	44
Synedra	85
Tabellaria	4

TENNESSEE RIVER
CHATTANOOGA, TENNESSEE

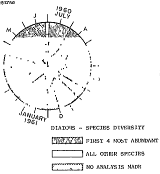
Semimonthly Samples
from July 1960 to July 1961

DIATOMS - PERCENT OCCURRENCE



Others in first 4 species
but not in first 2

Achnanthes minutissima
Asterionella formosa
Cocconeis placentula
Cyclotella pseudostelligera
Fragilaria crotonensis
Nitzschia holsatica
Stephanodiscus niagarae
Melosira sp.

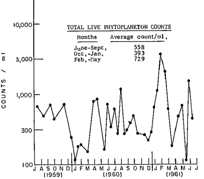


DIATOMS - SPECIES DIVERSITY

Z O O P L A N K T O N

Samples analyzed 22
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers.	18	22.5
Keratella	15	10.6
Polyarthra	9	5.0
Brachionus	4	0
Synchaeta	7	0.6
Other genera	11	3.0
Crusraceans.		
nauplii	3	0
copepods	2	0
cladocerans	2	0
Nematodes		2
Other invertebrate metazoans		0



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	558
Oct.-Jan.	393
Feb.-May	729

M O S T A B U N D A N T G E N E R A O F A L G A E

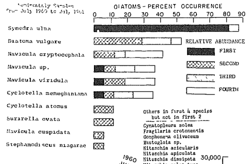
Percent frequency of counts
150 per ml. or more
From May 1959 to May 1961

Green algae	
Scenedesmus	2
Diatoms	
Centric	
Cyclotella	2
Melosira	25
Stephanodiscus	18
Pennate	
Asterionella	2
Fragilaria	2
Synedra	7

YELLOWSTONE RIVER
SIDNEY, MONTANA

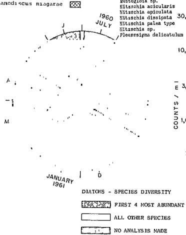
Semimonthly Samples from July 1960 to July 1961

DIATOMS - PERCENT OCCURRENCE



Others in first 4 species but not in first 2

- Cymatopleura solea
- Fragilaria crotonensis
- Gomphonema olivaceum
- Mastogloia sp.
- Nitzschia acicularis
- Nitzschia apiculata
- Nitzschia dissipata
- Nitzschia palea type
- Nitzschia sp.
- Pleurosigma delicatulum

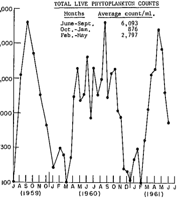


DIATOMS - SPECIES DIVERSITY

ZOOPLANKTON

Samples analyzed 22
July 1960 to July 1961

	Samples with Animals	Average count per liter per sample
Rotifers:	5	0.8
Keratella	2	0.2
Polyarthra	1	0
Brachionus	0	0
Synchaeta	1	0.1
Other genera	3	0.5
Crusraceans		
nauplii	2	0.2
copepods	0	0
cladocerans	0	0
Nematodes		2.
Other invertebrate metazoans	0	



TOTAL LIVE PHYTOPLANKTON COUNTS

Months	Average count/ml.
June-Sept.	6,093
Oct.-Jan.	876
Feb.-May	2,797

MOST ABUNDANT GENERA OF ALGAE

Percent frequency of counts 150 per ml. or more
From May 1959 to May 1961

Blue-green algae	
Anacystis	8
Gomphosphaeria	3
Green algae	
Actinastrum	5
Ankistrodesmus	11
Gloeocystis	3
Oocystis	5
Scenedesmus	18
Tetradesmus	3
Green flagellates	
Chlamydomonas	8
Trachelomonas	5
Diatoms	
Centric	
Cyclotella	26
Stephanodiscus	18
Pennate	
Caloneis	3
Cocconeis	3
Cymbella	11
Diatoma	13
Epithemia	3
Fragilaria	16
Gomphonema	8
Navicula	53
Nitzschia	34
Surirella	11
Synedra	55